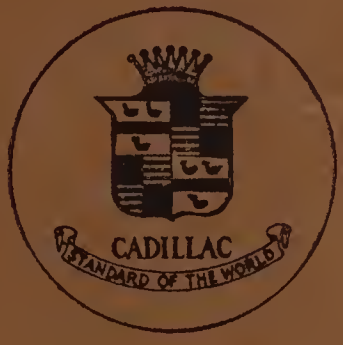
TL 215
.C3
1918
Copy 1

Manual of
Adjustment, Repair and Lubrication

Type 57



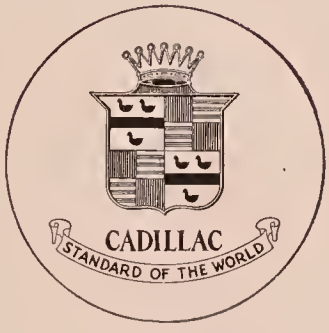
For shop use

Cadillac Motor Car Company
Detroit, Michigan, U. S. A.

Manual of

Adjustment, Repair and Lubrication

Type 57



For shop use

Cadillac Motor Car Company
Detroit, Michigan, U. S. A.

First Edition—Price $1.00
Copyrighted 1918

TL
.5
.C3
1918

JAN -2 1919

©CLA511193

#1.00

no1

PREFACE

The directions, suggestions and information contained in this manual represent actual experience in the shops of the Cadillac Motor Car Company. Part One deals with adjustments; Part Two with the removal, inspection and replacement of parts, and Part Three with lubrication. This manual is intended for shop use strictly, and has been compiled with this end in view.

It has always been the practice in the manufacture of Cadillac motor cars to machine parts to limits and to inspect parts before they are assembled into cars to make certain that they have been held to the established limits in manufacture. A result of this practice is that correct clearances between moving parts are assured.

One of the objects of this manual is to establish limits for use in the inspection of parts which have seen service. These limits are supplied in Part Two under headings "Inspection." The limits named are those beyond which it is inadvisable to continue to use parts, if quietness of operation and maximum efficiency are expected in the operation of the car, but not necessarily beyond which some service, in normal use, cannot be obtained.

Suitable micrometers and dial indicators are necessary in making these inspections.

This manual will not only assist the repair man schooled in Cadillac shops, but will make it possible for the trained mechanic without previous Cadillac shop experience to adjust, repair and lubricate Cadillac cars correctly.

Our Technical Department invites correspondence with shop foremen and shop superintendents on matters pertaining to the care, adjustment and repair of Cadillac motor cars. Suggestions regarding these matters are appreciated.

CADILLAC MOTOR CAR COMPANY
Detroit, Michigan.

TABLE OF CONTENTS

Part I. Adjustments 9-54
Part II. Removal, Inspection and Replacement 55-148
Part III. Lubrication 149-157

INDEX

A

Page

Acid in storage battery 29
Adjustments—
Bearings, Caution in adjusting Timken 53
Bearings, Connecting rod 9
Bearings, Crankshaft, Main 9
Bearings, Gear and pinion (Rear axle) 42
Bearings, Spindle 49
Bearings, Wheel, Front 51
Bearings, Wheel, Lubrication of ... 157
Bearings, Wheel, Rear 52
Bearings, Worm thrust (Steering gear) 49
Brakes, Foot (External) 46
Brakes, Hand (Internal) 47–48
Cam slide 13
Carburetor 37
Clutch pedal clearance 41
Clutch pedal, Length of 41
Clutch pedal stop 41
Contact points, Timer 23
Gears for proper meshing (Rear axle) 44
Headlamps, Focusing 20
Oil pressure regulator 154
Rear axle gears 42–44
Sector shaft (Steering gear) 51
Steering gear 49–51
Valves, Thermostat 35
Wheels, Front, Alignment of 52
Alignment of front wheels 52
Ammeter 26
Anti-freezing solution 32
Automatic throttle 39
Axle shafts (Removal, Inspection, Replacement) 128-129
Axles (See Front Axle and Rear Axle) ..... 42 and 49

B

Baffle plate (Oil pan) 78
Bands, Brake, Relining 49
Battery, Storage (see Storage Battery) 28
Bearings—
Ball, Annular, Removal of (Distributor and Timer) 102
Ball thrust, Removal of (Clutch) .. 112
Caution in adjusting Timken 53
Connecting rod, Adjustment of 9

Bearings—*Continued*

Page

Crank pin (Removal, Inspection, Replacement) 55–58
Crank pin, Fitting 10
Crank pin, Fitting new standard size 10
Crank pin, Fitting new undersized. 10
Crank pin, Refitting used 10
Crankshaft, Main, Adjustment of . 9
Crankshaft, Main, Fitting 11
Crankshaft, Main (Removal, Inspection, Replacement) 58–59
Dressing down crankshaft bearing surfaces 11
Fanshaft (Removal, Inspection, Replacement 59–60
Gear and pinion, Adjustment of (Rear axle) 42
Grease for wheels 149
Plain, Removal of (Distributor and Timer) 101
Removal of annular ball bearing (Motor generator) 97
Removal roller bearing (Motor generator) 97
Spindle, Adjustment of 49
Transmission clutch connection [Rear bearing] (Removal, Inspection, Replacement) 115–116
Transmission shaft, Main [Rear bearing] (Removal, Inspection, Replacement) 120–121
Wheel, Front, Adjustment of 51
Wheel, Front, Removal of (Inspection, Replacement) 140–142
Wheel, Rear, Adjustment of 52
Wheel, Rear, Removal of (Inspection, Replacement) 140–142
Worm thrust, Adjustment of 49
Bent parts, Straightening 53
Blocks, Cylinder (Removal, Inspection, Replacement) 60-63
Body (Removal, Replacement) 146
Body and top, Storage of 16
Breakers, Circuit 93
Brakes (Adjustments) 46–49
Foot (External) Adjustment of 46
Hand (Internal) Adjustment of .. 47–48
Illustration of 47
Relining 49
Brushes—
Fitting motor generator 18
Removal of generator 97
Removal of motor 97
Bulbs, Lamp 20

C

Page

Cam, Placing in position 13
Cams, Positions of, for adjusting cam slides 12
Camshaft (Removal, Inspection, Replacement) 86–87
Cam slides—
  Adjustment of 13
  Position of cams for adjustment of. 12
Cam slides and guides (Removal, Inspection, Replacement) 91
Carburetor (Removal, Disassembly, Inspection, Replacement) 105–109
  Adjustment of 37
  Automatic throttle 39
  Float, Setting of 39
  Illustration of ..... 38 and 106
  Throttle pump 39
Caution in adjusting Timken bearings 53
Chains—
  Camshaft driving chain (Removal, Inspection, Replacement) 64–65
  Fan shaft driving chain (Removal, Inspection, Replacement) 65–66
  Looseness of [Camshaft] (Removal, Inspection, Replacement) 64
  Looseness of [Fanshaft] (Removal, Inspection, Replacement) 65
  Riveting 14
Chambers, Settling 37
Circuit breaker 93
Cleaning cooling system 34
Clutch (General description) 40
Clutch (Removal, Inspection, Replacement) 111–113
  Connection [Transmission] (Removal, Inspection, Replacement) 115–116
  Connection, Rear bearing (Removal, Inspection, Replacement) 115–116
  Discs, Relining 40
  Discs, Removal of 112
  Driving, Removal and Disassembly of (Motor generator) 96
  Illustration of 117
  Pedal, Adjustment of length of.... 41
  Pedal clearance, Adjustment of ... 41
  Pedal stop, Adjustment of 41
  Removal of 112
  Spring, Removal of 112
  Thrust ball race, Lubrication of... 157
Commutator 18
Compressor—
  Power air [Gasoline system] (Removal, Inspection, Replacement) 109–110
  Tire air (Removal, Inspection, Replacement) 113–115
Connecting rods (Removal, Inspection, Replacement) 82–85
  Bearings, Adjustment of 9
  Steering (Disassembly, front and rear, Inspection, Replacement) 139–140
Control lever (Removal, Inspection, Replacement) 118–119
Cooling System (Description)..... 32–36
Cooling system (Removal, Inspection, Replacement) 103–105
  Anti-freezing solution 32
  Cleaning 34
  Draining 34
  Filling 34
  Illustration showing path of circulation 33
  Pump packing glands, Water 35
  Radiator (Removal, Inspection, Replacement) 103–104
  Strainers, Water pump. 35 and 104-105
  Thermostat valves, Adjustment of. 35
Cover plate—
  Front (Removal, Inspection, Replacement) 75–76
  Top (Removal, Inspection, Replacement) 76–77
Crank case (Removal, Inspection, Replacement) 63–64
Crank pin—
  Bearings (Removal, Inspection, Replacement) 55–58
  Bearings, Fitting 10
  Bearings, Fitting new standard size 10
  Bearings, Fitting new undersize... 10
  Bearings, Refitting used 10
  Surfaces, Dressing down 11
Crankshaft—
  Bearings, Main, Adjustment of ... 9
  Bearings, Main, Fitting 11
Cup grease, Cadillac 149
Cylinder—
  Blocks (Removal, Inspection, Replacement) 60–63
  Heads (Removal, Inspection, Replacement) 71–72

D

Danger of running engine in closed garage, Personal 39
Delco electrical system (see Electrical system) 16–32
Depots, Exide 32
Diagram—
  Charging battery from 110 volt D. C. circuit 30
  Circuit 21
  Lubrication 156
  Wiring 19
Differential and large driven gear (Removal, Inspection, Replacement) 126-127
Disassembly—
  Axle, Front 132
  Axle, Rear 125
  Carburetor 105
  Compressor, Tire air 113
  Differential and large driven gear.. 126
  Engine 68
  Joints, Universal 124

Disassembly—*Continued* Page
Springs 145
Steering gear 137
Transmission 122
Discs, Clutch, Relining 40
Distributor and Timer (Description). 22
Distributor and Timer (Removal, Inspection, Replacement) 100–103
Contact points, Adjustment of. . . . 23
Head (Removal, Inspection, Replacement) 99
Ignition, Timing 23
Illustration of . . . . . 23 and 101
Lubrication mechanism in distributor housing 157
Rotor (Removal, Inspection, Replacement) 99–100
Rotor button track, Cleaning. 23
Draining cooling system. 34
Dressing down bearing surfaces—
Crankpin 11
Crankshaft. 11
Main. 11
Driving pinion and pinion shaft (Removal; Inspection, Replacement). . 129

E

Electrical system (Description) . . . 16–32
Electrical system (Removal, Inspection, Replacement). 93–103
Circuit breaker 25
Current, Generation of. 26
Diagram, Circuit. 21
Diagram, Wiring. 19
Distributor head (Removal, Inspection, Replacement) 99
Distributor rotor (Removal, Inspection, Replacement) 99–100
Distributor and Timer (Removal, Inspection, Replacement) 100–103
Ignition system. 22
Lamps. 20
Motor generator 16
Motor generator (Testing, Removal, Inspection, Replacement) 94–99
Storage battery. 28
Engine (Removal, Disassembly, Inspection). 66–69
Engine (Removal, Inspection, Replacement of parts) 55–93
Engine (Adjustments) 9–16
Bearings, Crankpin (Removal, Inspection, Replacement) 55–58
Bearings, Fanshaft (Removal, Inspection, Replacement) 59-60
Bearings, Main (Removal, Inspection, Replacement) 58–59
Camshaft (Removal, Inspection, Replacement) 86–87
Cam slides and guides (Removal, Inspection, Replacement) 91
Chain, Camshaft driving (Removal, Inspection, Replacement) 64–65
Chain, Fanshaft driving (Removal, Inspection, Replacement) 65–66

Engine—*Continued* Page
Chains, Riveting. 14
Connecting rods (Removal, Inspection, Replacement) 82–85
Connecting rod and crankshaft bearings, Adjustment of. 9
Cover plate, Front (Removal, Inspection, Replacement) 75–76
Cover plate, Top (Removal, Inspection, Replacement) 76–77
Crankcase (Removal, Inspection, Replacement) 63–64
Crankpin bearings, Fitting. 10
Crankshaft (Removal, Inspection, Replacement) 87–89
Crankshaft bearing surfaces, Dressing down. 11
Cylinder blocks (Removal, Inspection, Replacement) 60–63
Cylinder heads (Removal, Inspection, Replacement). 71–72
Data, General 8
Fan, (Removal, Inspection, Replacement) 70
Firing order 12
Flywheel (Removal, Inspection, Replacement) 92–93
Gear Spiral, for oil pump (Removal, Inspection, Replacement). 70–71
Illustration of. . . . . 56 and 61
Lubrication. . . . . 150 and 157
Manifold, Intake (Removal, Inspection, Replacement) 73
Number, Location. 8
Oil pan and baffle plate (Removal, Inspection, Replacement) 78
Piston pins (Removal, Inspection, Replacement) 73–74
Piston and piston rings (Removal, Inspection, Replacement) 74–75
Pump, Oil (Removal, Inspection, Replacement) 79
Pumps, Water (Removal, Inspection, Replacement). 80–81
Regulator, Oil pressure (Removal, Inspection, Replacement) 82
Rocker arms and shafts (Removal, Inspection, Replacement) 55
Shaft, Drive, for water pump (Removal, Inspection, Replacement) 90
Storage 15
Valves. 12
Valves and Valve Springs (Removal, Inspection, Replacement) 91–92
Exide battery depots. 32
External brakes, Adjustment of. . . . 46
External brakes (Removal, Inspection, Replacement). 125–126

F

Fan (Removal, Inspection, Replacement). 70
Reassembly and Replacement 69
Fanshaft driving chain (Removal, Inspection, Replacement) 65–66

Fanshaft driving chain—*Continued* Page
Looseness of 65
Fanshaft housing (Removal, Inspection, Replacement) 72
Fenders (Removal, Inspection, Replacement) 147–148
Filling the cooling system 34
Filling the lubricating system 151
Firing order (Engine) 12
Fitting bearings—
Crankpin 10
Crankshaft, Main 10
Standard size, New 10
Undersize, New 10
Fitting brushes, Motor generator 18
Float, Carburetor, Setting 39
Flywheel (Removal, Inspection, Replacement) 92–93
Timing marks on 12
Focusing headlamps 20
Forks, Shifter [Transmission] (Removal, Inspection, Replacement) 120
Frame (Removal, Inspection, Replacement) 142–144
Front axle (Adjustments) 49
Front axle (Removal, Inspection, Replacement) 132–133
Bearings, Front wheels, Adjusting 51
Bearings, Spindle, Adjustment of 49
Parallel rod (Removal, Inspection, Replacement) 133–134
Spindles (Removal, Inspection, Replacement) 134–136
Stop screws, Spindle arms 49
Steering arms (Removal, Inspection, Replacement) 130–131
Wheel and bearings, Front (Removal, Inspection, Replacement) 140–142
Wheels, Front, Alignment of 52
Front cover plate (Removal, Inspection, Replacement) 75–76
Front wheels (Removal, Inspection, Replacement) 140–142
Alignment of 52
Bearings, Adjusting 51
Bearings (Removal, Inspection, Replacement) 140–142
Lubrication 149, 157

G

Garage, Personal danger of running car in 39
Gasoline system (Description and Adjustments) 36–39
Gasoline system (Removal, Inspection, Replacement) 105–109
Carburetor (Adjustments) 37
Carburetor (Removal, Inspection, Replacement) 105–109
Compressor, Power air (Removal, Inspection, Replacement) 109–110
Illustration of 37
Pressure relief valve 36
Gasoline system—*Continued* Page
Settling chambers 37
Strainers 37
Tank (Removal, Inspection, Replacement) 110–111
Gasoline tank capacity 8
Gauge, Gasoline quantity, Removal of 110
Gear—
Differential and large driven (Removal, Disassembly, Inspection, Replacement) 126–127
Spiral, for oil pump drive (Removal, Inspection, Replacement) 70–71
Steering (Adjustments) 49
Steering (Removal, Inspection, Replacement) 136–138
Gear and pinion bearings, Adjustment of (Rear axle) 42
Gear ratio—
Axle 8
Between engine and rear wheels 8
Transmission 8
Gears—
Adjustment of for proper meshing (Rear axle) 44
Jackshaft (Removal, Inspection, Replacement) 117–118
Shipper (Removal, Inspection, Replacement 116
Generator, Motor (Electrical system) 16–17
Brushes, Fitting 18
Generation of current 26
Grease—
Cup, Cadillac 149
Steering Gear, Cadillac 150
Wheel bearing, Cadillac 149
Universal joint, Cadillac 150
Grinding valves 14
Guides for cam slides (Removal, Inspection, Replacement) 91

H

Hand brakes (External) 47
Adjustment 47–48
Relining brake bands 49
Headlamps—
Bulbs 20
Focusing 20
Reflectors, Cleaning 20
Heads—
Cylinder (Removal, Inspection, Replacement) 71–72
Distributor (Removal, Inspection, Replacement) 99
Housing—
Axle, Rear (Removal, Inspection, Replacement) 127–128
Fanshaft, (Removal, Inspection, Replacement) 72
Worm and Sector, Steering gear (Removal, Inspection, Replacement) 139

I

Page

Ignition (Description, Adjustment).. 22
Coil..... 25
Condenser..... 25
Contact points, timer, Adjustment of..... 23
Distributor and timer..... 22
Distributor rotor button track, Cleaning..... 23
Resistance unit..... 24
Spark plugs..... 25
Timing ignition..... 23
Inspection—
Axle, Front.....132
Axle, Rear.....125
Baffle plate, (Oil pan)..... 78
Bearing, Fanshaft..... 60
Bearing, Main..... 59
Bearing, Rear, Clutch connection (Transmission).....115
Bearing, Rear, Main transmission shaft.....121
Bearings, Crankpin..... 57
Brakes.....126
Carburetor.....106
Camshaft..... 86
Cam slides and guides..... 91
Chain, Camshaft driving..... 64
Chain, Fanshaft driving..... 66
Circuit breakers 93
Clutch.....112
Clutch connection (Transmission).115
Compressor, Power air, in Gasoline system.....109
Compressor, Tire air.....114
Connecting rods..... 83
Control lever.....119
Cover plate, Front..... 76
Cover plate, Top..... 77
Crank case..... 64
Crankshaft..... 87
Cylinder blocks..... 62
Cylinder heads..... 71
Differential and large driven gear.126
Distributor head..... 99
Distributor rotor.....100
Distributor and timer.....102
Dust shields.....147
Engine..... 69
Fan..... 70
Fanshaft..... 60
Fanshaft housing..... 72
Fenders.....148
Flywheel..... 93
Frame.....143
Gasoline tank.....110
Gear, Large driven (Rear axle)...126
Gear, Spiral, for oil pump..... 70
Gears, Jackshaft.....118
Gears, Shipper.....116
Generator..... 98
Guides, for cam slides..... 91
Housing for steering gear worm and sector.....139
Housing, Rear axle.....127
Intake manifold..... 73
Jackshaft and jackshaft gears.....118

Inspection—*Continued* Page
Joints, Universal.....124
Motor generator..... 98
Oil pan and baffle plate..... 78
Oil pump..... 79
Parallel rod.....133
Pinion, Driving, and pinion shaft..129
Pinion, Reverse (Transmission)...119
Piston and piston rings..... 74
Piston pins..... 73
Pumps, water..... 81
Radiator.....104
Regulator, Oil pressure..... 82
Rings, Piston..... 74
Rocker arms and shafts..... 55
Rotor, Distributor.....100
Running boards and dust shields..147
Shaft, axle.....128
Shaft, Drive, for water pumps.... 90
Shaft, Main, Transmission.....121
Shaft, Pinion.....129
Shafts, for shifter forks.....120
Shifter forks and shafts.....120
Spindles, Axle, Front.....135
Springs.....145
Springs, Valve..... 92
Steering arms.....131
Steering connecting rod.....140
Steering gear.....137
Strainers, Water pumps.....105
Tank, Gasoline.....110
Timer.....102
Transmission.....123
Transmission case.....111
Universal joints.....124
Valves and valve springs..... 92
Wheels.....142
Intake manifold (Removal, Inspection, Replacement)..... 73
Internal brakes (Foot)..... 46
Adjustment of..... 46

J

Jackshaft and jackshaft gears [Transmission] (Removal, Inspection, Replacement).....117–118
Jackshaft gears (Removal, Inspection, Replacement).....117–118
Joints, Universal (Description)..... 42
Joints, Universal (Removal, Inspection, Replacement).....123–124

L

Lamps..... 20
Lamp bulbs..... 20
Lever, Control (Removal, Inspection, Replacement).....118–119
Lubrication (General).....157
Bearings on armature shaft.....157
Bearings in fan hub.....157
Bearing at upper end of steering shaft.....157
Clutch thrust ball race.....157
Diagram.....156
Engine.....157

Lubrication—*Continued* Page
Engine rear support 157
Oil (see Lubricants) 149
Rear axle 155–157
Springs 157
Starter gear shaft 157
Steering gear 157
Tire air compressor 157
Transmission 155–157
Universal joints 157
Valve stems 157
Wheel bearings 157
Lubrication (Engine) .....150 and 157
Cold weather, Replacing oil frequently during 153
Filling lubricating system 151
Illustration of lubricating system .. 150
Lubricating system 150
Oil pressure 153
Regulator, Oil pressure, Adjustment of 154
Replace oil in engine 152
Lubricants—
Cadillac cup grease 149
Cadillac motor oil 149
Cadillac rear axle and transmission lubricant 149
Cadillac steering gear grease 150
Cadillac wheel bearing grease 149
Cadillac universal joint grease 150

M

Main bearings, (Removal, Inspection, Replacement) 58–59
Main bearing surfaces, Dressing down 11
Main crankshaft bearings, Adjustment of 9
Main crankshaft bearings, Fitting ... 11
Manifold, Intake (Removal, Inspection, Replacement) 73
Marks on flywheel, Timing 12
Motor 17
Motor generator (Description) 16
Motor generator (Removal, Inspection, Replacement) 94–99
Illustration .....17, 94 and 95
Inspection 98
Removal and disassembly of driving clutch 96
Removal of annular ball bearing .. 97
Removal of field coils 98
Removal of generator brushes 96
Removal of motor brushes 97
Removal of motor generator 97
Removal of roller bearing 97
Testing (on car) 94
Testing (off car) 95
Motor generator brushes, Fitting 18

N

Number, Engine 8

O

Page
Oil, Cadillac motor 149
Oil in engine, Replace 152
Oil in engine, Replace frequently during cold weather 153
Oil pan and baffle plate (Removal, Inspection, Replacement) 78
Oil pressure 153
Oil pressure regulator (Removal, Inspection, Replacement) 82
Adjustment of 154
Oil pump (Removal, Inspection, Replacement) 79
Order of firing (Engine) 12

P

Packing glands, Water pumps 35
Pan, Oil (Removal, Inspection, Replacement) 78
Parallel rod (Removal, Inspection, Replacement) 133–134
Parts, Straightening bent 53
Pedal, Clutch 41
Length, Adjustment of 41
Stop, Adjustment of 41
Pinion—
Driving, and pinion shaft [Rear axle] (Removal, Inspection, Replacement) 129
Reverse [Transmission] (Removal, Inspection, Replacement) 119
Shaft (Removal, Inspection, Replacement) 129
Piston and piston rings (Removal, Inspection, Replacement) 74–75
Piston pins (Removal, Inspection, Replacement) 73–74
Piston rings (Removal, Inspection, Replacement) 74–75
Plate—
Baffle (Removal, Inspection, Replacement) 78
Front cover (Removal, Inspection, Replacement) 75–76
Top cover (Removal, Inspection, Replacement) 76–77
Plugs, Spark 25
Points, Timer contact, Adjustment of 23
Position of cams for adjustment of cam slides 12
Power air compressor [Gasoline system] (Removal, Inspection, Replacement) 109–110
Pressure regulator, Oil (Removal, Inspection, Replacement) 82
Pressure relief valve 36
Pump—
Illustration of water pump 80
Oil (Removal, Inspection, Replacement) 79
Throttle (Carburetor) 39
Water (Adjustments) 35
Water (Removal, Inspection, Replacement) 80–81
Water, Drive shaft for (Removal, Inspection, Replacement) 90

Pump—*Continued* Page
Water, Packing glands 37
Water, Strainers (Removal, Inspection, Replacement) 104–105

R

Radiator (Removal, Inspection, Replacement) 103–104
Anti-freezing solution 32
Draining 34
Filling 34
Rear axle (Adjustments) 42-45
Rear axle (Removal, Inspection, Replacement) 124–125
Brakes (Adjustments) 46–49
Brakes (Removal, Inspection, Replacement) 125–126
Differential and large driven gear (Removal, Inspection, Replacement) 126–127
Gear and pinion bearings, Adjustment of 42
Gears for proper meshing, Adjustment of 44
Housing (Removal, Inspection, Replacement) 127–128
Illustration of 43
Lubrication of rear axle 156
Pinion, Driving, and pinion shafts (Removal, Inspection, Replacement) 129–130
Rear axle and transmission lubricant, Cadillac 149
Rear wheels (Adjustments) 51–53
Rear wheels (Removal, Inspection, Replacement) 140–142
Bearings, Adjustment of 52
Lubrication 156
Reassembly and replacement of fan 69-70
Reassembly and replacement of transmission 123
Refitting a used crank pin bearing .. 10
Regulator, Oil pressure (Removal, Inspection, Replacement) 82
Reflectors, Cleaning headlamp 20
Relief valve, Pressure (Gasoline system) 36
Relining clutch discs 40
Removal—
Axle, Front 132
Axle, Rear 124
Baffle plate (Oil pan) 78
Bearing, Annular ball (Motor generator) 97
Bearing, Fanshaft 59
Bearing, Main 58
Bearing, Rear, Clutch connection (Transmission) 115
Bearing, Rear, Main transmission shaft 121
Bearing, Roller (Motor generator) . 97
Bearings, Crankpin 55
Brakes 125-126
Brake band, External 125
Brake band, Internal 126
Carburetor 105

Removal—*Continued* Page
Crankshaft 87
Cam slides and guides 91
Chain, Camshaft driving 64
Chain, Fanshaft driving 66
Circuit breakers 94
Clutch 112
Clutch ball thrust bearing 112
Clutch connection (Transmission) . 115
Clutch discs 112
Clutch spring 112
Compressor, Power air (Gasoline) 109
Compressor, Tire air 113
Connecting rods 82
Control lever 118
Cover plate, Front 75
Cover plate, Top 76
Crankcase 63
Crankshaft 87
Cylinder blocks 60
Cylinder heads 71
Differential and large driven gear .. 126
Distributor head 99
Distributor rotor 99
Distributor and timer 100
Distributor annular ball bearing ... 102
Distributor gear 102
Distributor plain bearing 101
Distributor spring 102
Dust shields 147
Engine 66
Fan 70
Fanshaft 59
Fanshaft housing 72
Fenders, Front 147
Fenders, Rear 148
Field coils 98
Flywheel 92
Frame 142
Gasoline quantity gauge 110
Gasoline strainer 110
Gasoline tank 110
Gear, large driven (Rear axle) 126
Gear, Spiral, for oil pump 70
Gears, Jackshaft 117
Gears, Shipper 116
Generator 97
Generator brushes 96
Guides for cam slides 91
Housing for steering gear worm and sector 139
Housing, Rear axle 127
Intake manifold 73
Jackshaft and jackshaft gears 117
Joints, Universal 123
Motor brushes 97
Motor generator 97
Oil pan and baffle plate 78
Oil pump 79
Parallel rod 133
Pinion, Driving, and pinion shaft . 129
Pinion, Reverse (Transmission) ... 119
Piston and piston rings 74
Piston pins 73
Pump impeller 81
Pumps, Water 80

Removal—*Continued* Page
Radiator....103
Regulator, Oil pressure.... 82
Rings, Piston.... 74
Rocker arms and shafts.... 55
Rotor, Distributor.... 99
Running boards and dust shields..147
Shaft, Axle....128
Shaft, Drive, for water pump.... 90
Shaft, Main, Transmission....121
Shaft, Pinion....129
Shafts, for shifter forks....120
Shifter forks and shafts....120
Spindles, Axle, Front....134
Spring, Front....145
Spring, Rear....145
Springs, Valve.... 91
Steering arms....130
Steering connecting rod....139-140
Steering gear....136–137
Strainers, Water pumps....104-105
Tank, Gasoline....110
Thermostat.... 80
Thermostat valve.... 81
Timer....100-102
Transmission....121
Transmission case....111
Universal joints....123
Valves and valve springs.... 91
Wheels, Front, and bearings....140
Wheels, Rear, and bearings....141

Replace lubricant in transmission and rear axle....155
Replace oil in engine....152
Replace oil in engine frequently during cold weather....153

Replacement—
Acid, in storage battery, lost by spilling.... 29
Axle, Front....132
Axle, Rear....125
Baffle plate (Oil pan).... 78
Bearing, Fanshaft.... 60
Bearing, Main.... 59
Bearing, Rear, Clutch connection (Transmission)....116
Bearing, Rear, Main transmission shaft....121
Bearings, Crankpin.... 57
Brakes....126
Carburetor....109
Camshaft.... 87
Cam slides and guides.... 91
Chain, Camshaft driving.... 64
Chain, Fanshaft driving.... 66
Circuit breaker.... 94
Clutch....113
Clutch connection (Transmission)..116
Compressor, Power air (Gasoline system)....110
Compressor, Tire air....115
Connecting rods.... 85
Control lever....119
Cover plate, Front.... 76
Cover plate, Top.... 77
Crank case.... 64

Replacement—*Continued* Page
Crankshaft.... 89
Cylinder blocks.... 63
Cylinder heads.... 72
Differential and large driven gear..127
Distributor head.... 99
Distributor rotor....100
Distributor and timer....103
Dust shields....147
Fan.... 70
Fanshaft.... 60
Fanshaft housing.... 72
Fenders....148
Flywheel.... 94
Frame....144
Gasoline tank....111
Gear, Large driven (Rear Axle)...127
Gear, Spiral, for oil pump.... 71
Gears, Jackshaft....118
Gears, Shipper....116
Generator.... 99
Guides for cam slides.... 91
Housing for worm and sector....139
Housing, Rear axle....128
Intake manifold.... 73
Jackshaft and jackshaft gears....118
Joints, Universal....124
Motor generator.... 99
Oil pan and baffle plate.... 78
Oil pump.... 79
Parallel rod....133
Pinion, Driving, and pinion shaft.130
Pinion, Reverse (Transmission)...119
Piston and piston rings.... 75
Piston pins.... 74
Pumps, Water.... 82
Radiator....104
Regulator, Oil pressure.... 82
Rings, Piston.... 75
Rocker arms and shafts.... 55
Rotor, Distributor....100
Running boards and dust shields..147
Shaft, Axle....129
Shaft, Drive, for water pumps.... 90
Shaft, Main, Transmission....121
Shaft, Pinion....130
Shafts for shifter forks....120
Shifter forks and shafts....120
Spindles, Axle, Front....136
Springs....145
Springs, Valve.... 92
Steering arms....131
Steering connecting rod....140
Steering gear....138
Strainers, Water pumps....105
Tank, Gasoline....111
Timer....103
Transmission....123
Transmission case....111
Universal joints....124
Valves and valve springs.... 92
Wheels....142
Resistance unit.... 24
Reverse pinion [Transmission] (Removal, Inspection, Replacement)..119

Page

Rings, Piston (Removal, Inspection, Replacement) 74–75
Riveting chains (Engine) 14
Rocker arms and shafts (Removal, Inspection, Replacement) 55
Rod—
Connecting, Bearings, Adjustment of 9
Connecting (Removal, Inspection, Replacement) 82–85
Parallel rod (Removal, Inspection, Replacement) 133–134
Steering connecting rod (Removal, Inspection, Replacement) . . 139–140
Rotor button track, Distributor, Cleaning 23
Rotor, Distributor (Removal, Inspection, Replacement) 99–100
Running boards and dust shields (Removal, Inspection, Replacement) 146–147

S

Setting of carburetor float 39
Shafts—
Axle (Removal, Inspection, Replacement) 128–129
Drive shaft for water pumps (Removal, Inspection, Replacement) . . 90
Pinion shaft (Removal, Inspection, Replacement) 129–130
Rocker arm (Removal, Inspection, Replacement) 55
Shifter fork (Removal, Inspection, Replacement) 120
Transmission, Main (Removal, Inspection, Replacement) 120–121
Shields, Dust (Removal, Inspection, Replacement) 146–147
Shifter forks and shafts (Removal, Inspection, Replacement) 120
Shipper gears (Removal, Inspection, Replacement) 116
Spark plugs 25
Spindles—
Front axle (Removal, Inspection, Replacement) 134–136
Illustration of . . . . . 134 and 135
Spindle arm stop screws 49
Spindle bearing, Adjustment of 49
Spiral gear for oil pump drive (Removal, Inspection, Replacement) . . 70
Springs (Removal, Inspection, Replacement) 145
Lubrication of 157
Removal of distributor and timer spring 102
Valve (Removal, Inspection, Replacement) 91–92
Starter gear shaft, Lubrication of 157
Starting mechanism, Illustration of . . . 17
Steering arms (Removal, Inspection, Replacement) 130–131
Steering connecting rod (Removal, Inspection, Replacement) 139–140

Page

Steering gear (Adjustments) 49
Steering gear (Removal, Inspection, Replacement) 136–138
Illustration of 50
Lubrication 157
Sector shaft, Adjustment of 51
Thrust bearing, Worm, Adjustment of 49
Worm and sector, Adjustment of . . 50
Storage (Winter)—
Body and top 16
Engine 15
Storage battery 15
Taking car out of storage 16
Tires 15
Storage battery (Description) 28
Acid, Replacing 29
Charging from an outside source . . 29
Illustration 28
Placing battery in service (after storage) 31
Preparing battery for storage 31
Sediment in 32
Stop, Clutch pedal, Adjustment of . . . 41
Stop screws, Adjustment of (Brakes) . . . . . 46 and 48
Stop screws, Spindle arm 49
Straightening bent parts 53
Strainers—
Cooling system 35
Gasoline system 37
Water pumps (Removal, Inspection, Replacement) 104–105
Surfaces—
Crank pin, Dressing down 11
Crankshaft bearing, Dressing down 11
Main bearing, Dressing down 11

T

Tank capacity, Gasoline 8
Thermostat—
Illustration of 80
Removal of 80
Thermostat valves—
Adjustment of 35
Removal of 81
Throttle—
Automatic 39
Pump (Carburetor) 39
Timer [see Distributor and Timer] (Description) 22
Timer [see Distributor and Timer] (Removal, Inspection, Replacement) 100–103
Contact points, Adjustment of . . . 23
Timing ignition 23
Timing marks on flywheel 12
Timken bearings, Caution in adjusting 53
Tire air compressor (Removal, Inspection, Replacement) 113–115
Lubrication 157
Tires, Storage of 15
Top, Storage of 16

Page

Transmission (Description) 41
Transmission (Removal, Inspection, Replacement) 121–123
Bearing, Rear, Main shaft (Removal, Inspection, Replacement) 120–121
Case (Removal, Inspection, Replacement) 111
Construction 41
Illustration 117
Lubrication 157
Shaft, Main 120–121
Tread 8

U

Universal joints (Description) 42
Universal joints (Removal, Inspection, Replacement) 123–124
Disassembling of 124
Lubrication of 157

V

Valve—
Pressure relief 36
Springs (Removal, Inspection, Replacement) 91–92
Valve and valve springs (Removal, Inspection, Replacement) 91–92
Valve stems, Lubrication of 157

Page

Valves, Engine 12
Cam slide, Adjustment of 13
Cam slides, Position of cams for adjustment of 12
Grinding 14
Placing cam in position 13

W

Washing cars 54
Water, Adding to storage battery ... 28
Water pumps (Adjustments) 35
Water pumps (Removal, Inspection, Replacement) 80–81
Packing glands 35
Strainers 35
Strainers (Removal, Inspection, Replacement) 104–105
Thermostat valves, Adjustment of 35
Wheel base 8
Wheel bearings, Lubrication of 157
Wheels (Adjustments) 51–53
Wheels (Removal, Inspection, Replacement) 140–142
Alignment of front wheels 52
Bearings, Adjustment of front wheel 51
Bearings, Adjustment of rear wheel 52
Illustration rear wheel hub and bearings 141
Lubrication of 157
Wiring diagram 19

ILLUSTRATIONS

Name	Fig.	Page
AXLE, FRONT:		
Arm, Spindle—Left	44	131
Arm, Spindle—Right	43	130
Axle—Inverted Front, End View	46	133
Axle—Inverted Front, Side View	45	132
Spindle—Left Front	47	134
Spindle—Right Front, Sectional View	48	135
AXLE, REAR:		
Brake Rods	17	48
Brakes—Internal and External	16	47
Housing—Rear Axle, Side View	42	128
Housing—Rear Axle, Top View	41	128
Rear Axle, Sectional View	15	43
CLUTCH AND TRANSMISSION:		
Clutch Control	14	41
Clutch and Transmission, Sectional View	39	117
Compressor, Tire Air—Sectional View	38	114
COOLING SYSTEM:		
Cooling System	10	33
Strainer, Left-Hand Water—Removal of	35	105
ELECTRICAL SYSTEM:		
Battery—Storage, Sectional View	8	28
Clutch—Motor Generator Driving, Rear View	33	96
Diagram—Circuit	6	21
Diagram—Wiring	5	19
Diagram of Connections for Charging Battery from 110 Volt D. C.	9	30
Distributor and Timer, Sectional View	34	101
Motor Generator, Front View	31	94
Motor Generator, Rear View	32	95
Motor Generator and Starting Mechanism	4	17
Timer	7	23
ENGINE:		
Diagram—General Lubrication	54	156
Engine—Cross Section of, Front View	23	61
Engine—Cross Section of, Side View	22	56
Firing Order	1	12
Flywheel, Showing Timing Marks	2	12
Lubricating System—Engine	51	150
Oil Filler, Pressure Regulator, Level Plug and Drain Plug	52	152
Pins, Rocker and Seat—Correct Positions for, in Riveting Chains	3	14
Regulator—Oil Pressure, Sectional View	53	154
Rings, Piston—Removing	26	74
Rods, Forked Connecting—Method Employed in Testing Alignment of	28	84
Rods, Straight Connecting—Method Employed in Testing Alignment of	29	84
Rope—Location of, in Lifting Engine from Frame	25	68
Pump—Water, Sectional View	27	80
Slide—Cam, and Adjusting Nut	30	91
Sprockets and Chain—Cam Shaft Driving	24	65
FRAME:		
Frame	50	144
GASOLINE SYSTEM:		
Automatic Throttle, Carburetor—Testing Spring of	37	107
Carburetor, Sectional View	36	106
Carburetor, Side View	13	38
Gasoline System	12	37
Valve—Air Pressure Relief, Sectional View	11	36
STEERING GEAR:		
Housing and Arm—Steering Gear	19	51
Steering Gear, Sectional View	18	50
UNIVERSAL JOINTS:		
Universal Joints and Drive Shaft	40	123
WHEELS:		
Bearings and Adjusting Nuts—Front Wheel	20	51
Bearings and Adjusting Nuts—Rear Wheel	49	141
Front Wheels—Diagram Showing Method of Aligning	21	52

GENERAL SUGGESTIONS

Do not use shellac on gaskets or on hose connections. Its use is unnecessary and makes practically impossible the removal of parts without injury.

Before replacing gaskets make certain that they are in good condition and that the surfaces which press against them are clean and in good condition.

In removing sprockets, gears, collars, etc., do not tap them off, unless you have no suitable puller and are unable to procure one. If you are forced to tap off parts, do so carefully, using a lead hammer or a drift of soft brass.

Use well fitting wrenches and only enough force to tighten parts properly. The amount of force required depends upon the size of the stud or cap screw and the length of the wrench. Do not tighten a nut or cap screw sufficiently to strain the parts.

Select well fitting screw drivers in removing and replacing screws.

The replacement of parts will be facilitated if a practice is made of observing the manner in which they are assembled, before taking them apart.

If parts do not disassemble readily do not injure or break them by using too much force. Parts will disassemble easily when correct methods are employed and proper tools are used.

Care should be exercised to prevent the loss or injury of parts removed.

Lubricate parts which move upon one another with suitable lubricant before putting them together. This includes such parts as spring shackle bolts, brake rod pins and the like, as well as pistons, engine bearings, etc.

Do not use waste in cleaning cylinders, pistons, bearings, gears, etc. Use cloth free from lint.

GENERAL DATA

ENGINE:

Number of cylinders.....8
Bore of cylinders.....3⅛ inches
Stroke.....5⅛ inches
Piston displacement.....314 cu. in.
Horse power (N. A. C. C. Rating).....31.25
Crankshaft diameter.....1⅞ inches
Valve size.....1 11/16 inches
Valve lift..... 5/16 inch
Carburetor size.....1½ inches
Spark plug size.....⅞ inch x 18

Engine revolutions per mile (Transmission Direct Drive):

Gear Ratio, Standard.....	Tires 35 inches	2557 (approx.)
	Tires 34 inches	2632 (approx.)
Gear Ratio, Low.....	Tires 35 inches	2922 (approx.)
	Tires 34 inches	3008 (approx.)

ENGINE NUMBER: The number of the engine is stamped on the crankcase just back of the right-hand block of cylinders, on the left-hand side of the fanshaft housing and on the name plate attached to the front face of the dash.

GEAR RATIOS:

Axle:

Standard	4.437-1
Low	5.071-1

Transmission:

High	Direct
Intermediate	58.65% of direct
Low	32% of direct
Reverse	26.70% of direct

Between Engine and Rear Wheels:

Axle gear ratio, Standard:

Transmission gear	High	4.437–1
	Intermediate	7.565–1
	Low	13.866–1
	Reverse	16.618–1

Axle gear ratio, Low:

Transmission gear	High	5.071–1
	Intermediate	8.646–1
	Low	15.847–1
	Reverse	18.993–1

WHEEL BASE:

Seven-Passenger, Phaeton, Four-Passenger, Roadster, Two-Passenger, Victoria and Brougham.....125 inches
Limousine, Imperial, Landaulet, Town Limousine, Town Landaulet and Suburban.....132 inches
Long Chassis.....145 inches

TREAD:

All Cars..... 56 inches

GASOLINE TANK CAPACITY:

Gallons:

United States	20
Imperial	16.67
Liters	75.70

PART I
ADJUSTMENTS

ENGINE

ADJUSTMENT OF CONNECTING ROD AND CRANKSHAFT BEARINGS

Adjustment of Connecting Rod Bearings

Remove the oil pan and baffle plate. (See "Removal" under "Oil Pan and Baffle Plate," page 78).

The caps at the lower ends of the single connecting rods are adjustable. Liners varying in thickness from .002 inch to .006 inch are placed between the caps and the rods when the engine is assembled. To readjust, remove these liners and substitute thinner ones of the proper thickness.

These bearings should have from .0025 inch to .0035 inch play. Bearing trouble is probable if the clearance is less than .0025 inch.

The crank pin bearings in the forked connecting rods are not adjustable. If there is more than .006 inch clearance between a bearing and the crank pin, or more than .015 inch end play in the bearing, a new bearing should be substituted. (See under "Fitting Crank Pin Bearings," page 10).

Adjustment of Main Crankshaft Bearings

Remove the oil pan and the baffle plate. (See "Removal" under "Oil Pan and Baffle Plate," page 78).

The three main bearings are provided with liners which are clamped between the crankcase and the bearing caps.

To tighten a main bearing, proceed as follows: Remove the oil feed pipe connecting the bearing cap with the oil manifold. Remove the aluminum bearing cap with the lower half of the bearing and the liners.

Replace the liners with liners which are less in thickness by an amount equal to the amount of "take-up" necessary. The clearance between the shaft and the bearings should be between .001 inch and .002 inch. Liners can be obtained from the Cadillac Motor Car Company varying in thickness by .001 inch.

Carefully reduce the upper edges of the lower half of the bearing *just enough* to allow the aluminum bearing cap to clamp the new liners. This work must be done very accurately, as clearance between the halves of the bearing will cause an oil leak.

The upper edges of the lower half of the bearing may be reduced by rubbing the bearing on a piece of fine emery cloth stretched tightly over a flat, machined, iron surface.

Thoroughly clean the bearing, bearing cap and liners and oil the bearing surface before replacing.

In replacing the bearing cap, tighten the bearing nuts firmly and lock with cotter pins. Also make sure that the union nuts on the oil pipe are tightened sufficiently to prevent leakage.

If more than one bearing is removed at a time, care should be taken not to mix the liners, as they may not all be the same thickness.

After replacing the oil pan, refill it with 1½ gallons of suitable engine oil. Cadillac Motor Oil is recommended.

FITTING CRANK PIN BEARINGS

If the crank pins of the crankshaft are scored or out of round more than .003 inch they should be dressed down before used bearings are refitted, or new bushings are installed. (See under "Dressing Down Crankshaft Bearing Surfaces," page 11).

Refitting a Used Bearing

If the babbitt is scored, rough, or shows only partial bearing on the crank pin, clean it up with a scraper. This work should be attempted only by workmen familiar with bearing scraping. The work must be done carefully to prevent an excessive flow of oil by the bearing.

If, after completing the work, the clearance between the bearing and the crank pin exceeds .006 inch, a new bearing should be substituted.

The end play in a crank pin bearing should not exceed .015 inch.

Fitting a New Standard Size Bearing

Crank pin bearings of standard size are reamed before shipment and should not be scraped unless the bearing surface becomes injured.

If there is more than .006 inch clearance between a new standard size bearing and the crank pin, an undersize bearing should be fitted. Bearings reamed .005 inch undersize are furnished by the Cadillac Motor Car Company.

The end play in a crank pin bearing should not exceed .015 inch.

Fitting a New Undersized Bearing

Crank pin bearings reamed .005 inch undersize are furnished by the Cadillac Motor Car Company for use where the clearance between a crank pin and a new standard size bearing exceeds .006 inch.

The desired clearance between the bearing and the crank pin is from .002 inch to .003 inch. The clearance must in no case be less than .002 inch or more than .006 inch.

Undersize bearings are reamed and should be scraped only in the event they clamp the crank pin, or the clearance between the pin and bearing is less than .002 inch.

FITTING MAIN CRANKSHAFT BEARINGS

If the bearing surface is rough, scored, or shows only a partial bearing on the shaft, it should be cleaned up with a scraper. This work should be attempted only by workmen who thoroughly understand bearing scraping. The work must be carefully done to prevent an excessive flow of oil by the bearing.

When clamped in place the clearance between a main bearing and the shaft should be from .001 inch to .002 inch.

After scraping the bearing halves reduce the edges, which come together, sufficiently to give the proper clearance between the bearing and the shaft. This may be done by rubbing the halves of the bearing over fine emery cloth stretched tightly over a surface plate.

Replace the liners with liners of the proper thickness. (See under "Adjustment of Main Crankshaft Bearings," page 9).

DRESSING DOWN CRANKSHAFT BEARING SURFACES

Main Bearing Surfaces

Crankshaft bearing surfaces should be smooth, free from scores and round within .003 inch. If not they should be dressed down.

This work should be attempted only by workmen who thoroughly understand work of this kind. To get the best results the shaft should be removed from the engine and placed on V blocks before starting the work.

Use a fine mill file and finish the work with fine emery cloth and oil. Make frequent tests with micrometers.

After the shaft is in proper condition, refit the bearings in accordance with directions under "Fitting Main Crankshaft Bearings," on this page.

Crank Pin Surfaces

Follow the directions under "Main Bearing Surfaces" in dressing down crank pins.

If there is more than .006 inch clearance between a crank pin and the bearing after the work is completed a new bearing should be substituted. (See under "Fitting Crank Pin Bearings," page 10).

FIRING ORDER

The order in which the cylinders fire is indicated in Fig. 1.

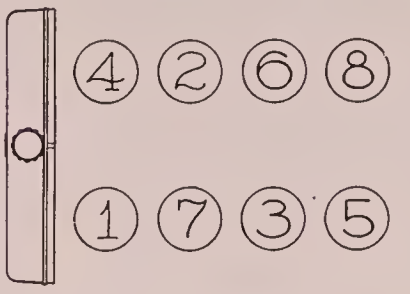


Fig. 1—Firing Order.

TIMING MARKS ON FLYWHEEL

The flywheel marks (see Fig. 2) are arranged in four groups, each group consisting of the following marks in order:

"IN|S"—"Inlet setting"
"IG|A"—"Ignition advance"
"C"—"Center"
"EX|S"—"Exhaust setting"

Fig. 2—Flywheel Showing Timing Marks.

Each group of marks refers to two cylinders, the numbers of which are stamped one on each side of the "C" in that group.

Complete instructions for using the "inlet setting" and "exhaust setting" marks are given below under "Positions of Cams for Adjustment of Cam Slides." The ignition timing is explained fully under "Timing Ignition," page 23.

ENGINE VALVES

Positions of Cams for Adjustment of Cam Slides

In poppet valve gasoline engines it is necessary for a cam roll to be on the circular surface of the cam when the cam slide operated by that cam is being adjusted. The shape of the circular portion of the cams in the Cadillac eight-cylinder engine is such that it is not sufficient for a cam roll simply to be on the circular surface of the cam. The cam roll must be on a certain small arc of the circular surface of the cam when the cam slide is being adjusted.

As no two cams on the camshaft are in the same position at the same time, it is necessary, before adjusting each cam slide, to place the corresponding cam in the proper position by cranking the engine by

hand as described below. The cam slides cannot be properly adjusted with the cams in any but the correct positions.

Placing Cam in Position

To place a cam in position for properly adjusting the cam slide, proceed as follows:

Open the compression relief cocks on the cylinder blocks and with the ignition switched off crank the engine slowly by hand in the direction in which it runs until the piston in the cylinder in which the valve is located is at the end of the compression stroke, or in other words, on firing center. This may be determined by placing a finger over the compression relief cock while cranking the engine. When the piston is exactly on firing center the pointer attached to the crankcase will then be directly over the mark on the flywheel indicating "center" for that cylinder.

INLET VALVE. If the valve operated by the cam slide is an inlet valve, select the first "IN|S" to the left of the center mark and mark it with a piece of chalk.

Crank the engine further by hand in the direction in which it runs until that "IN|S" is directly under the pointer. It will be necessary to crank the engine nearly a complete revolution.

The cam is then in the correct position for adjusting the cam slide operating that inlet valve. (See under "Adjustment of Cam Slide.")

EXHAUST VALVE. If the valve operated by the cam slide is an exhaust valve, after cranking the engine to the proper firing center, select the first "EX|S" to the right of the center mark and mark it with a piece of chalk.

Crank the engine further by hand in the direction in which it runs until this "EX|S" is under the pointer.

Then crank the engine further one complete revolution until this "EX|S" is again directly under the pointer.

The cam is then in the correct position for adjusting the cam slide operating that exhaust valve. (See under "Adjustment of Cam Slide.")

Adjustment of Cam Slide

When the cam is in the proper position (see under "Positions of Cams for Adjustment of Cam Slides"), the clearance between the end of the valve stem "A," Fig. 30, and the adjusting screw "B" in the cam slide "D" should be from .002 inch to .003 inch when the engine is cold.

To adjust a cam slide, loosen the locking nut "C" and turn the adjusting screw "B."

Tighten the locking nut "C" when the proper clearance has been obtained, taking care that in so doing the adjustment of the screw "B" is not disturbed.

Grinding Valves

Remove the valve. (See "Removal" under "Valves and Valve Springs," page 91).

It is a good plan to wrap soft string around the stem of the valve near the head. This will tend to prevent the grinding compound getting into the valve guide.

In the absence of a good prepared grinding compound, make a paste of powdered glass or flour of emery, mixed with thin oil.

Place the grinding compound on that portion of the valve which bears on the valve seat. Then replace the valve, and with a screw driver, or other suitable tool, rotate it back and forth about one-third revolution, with only a slight pressure on the tool. Lift the valve occasionally and turn it to a new position. Continue the grinding operation only until the valve and its seat show perfect bearing.

Then thoroughly wash the valve, the valve chamber and the valve guide with kerosene or gasoline. Be very careful to leave none of the grinding compound in any part of the cylinder, as it will cause serious damage if it works into the cylinder bore or other parts of the engine; also remove the string from the valve stem. Replace the valve.

After replacing the valve, retime it. (See under "Adjustment of Cam Slide," page 13). Retiming is necessary as the amount of clearance between the valve and the adjusting screw in the cam slide is necessarily reduced during the grinding operation.

RIVETING CHAINS

Each joint of the chain contains two pins, as shown in Fig. 3; a seat pin "A," which is ribbed, and a rocker pin "B," which is plain. If a chain is removed, be very sure in replacing it that the joint pins are inserted as shown.

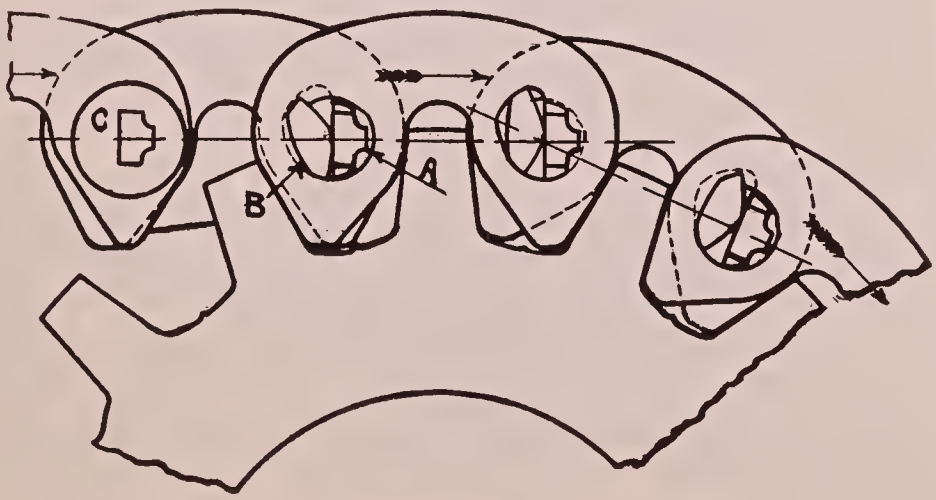


Fig. 3—Correct Positions for Rocker and Seat Pins in Riveting Chains.

Bring the ends of the chain together on the larger sprocket. (See "Replacement" under "Camshaft Driving Chain" and "Fanshaft Driving Chain," pages 65 and 66.) Insert the rocker pin and a used or extra seat pin to align the links. Clamp the new seat pin in a vise and rivet the small washer "C" on one end.

Force the used seat pin out by inserting the new seat pin. Insert the new seat pin from the rear. In doing so be careful not to force out the rocker pin. Be sure to recover the used seat pin so that it will not get into the mechanism of the engine.

After the new seat pin is in place, turn the engine so that the connection is mid-way between the sprockets. Then insert a riveting block between the crankcase wall and the inner end of the seat pin to be riveted, place the small washer on the end of the seat pin and carefully peen over the end of the pin. Remove the riveting block.

If, in installing a chain, the rocker pin is inserted backwards it will cause a knock on the small sprocket which will quickly destroy the chain. It is absolutely essential that the joint pins be assembled correctly if the chain is to live and give quiet and satisfactory service.

STORAGE

Engine

To prepare the engine for storage proceed as follows:

Cover the radiator and run the engine at a speed which shows an ammeter reading of approximately 10 with all lights switched off until the engine is thoroughly warm. It usually requires from two to ten minutes to warm the engine.

After the engine is hot, shut off the flow of gasoline to the carburetor and immediately the engine starts to slow down from a lean mixture inject from two to three tablespoonfuls of clean fresh engine oil into the primary air inlet at the right-hand side of the carburetor. This will stop the engine.

Open the compression cocks. Inject from one to two tablespoonfuls of clean fresh engine oil into each cylinder and close the cocks.

Storage Battery

(See under "Preparing Battery for Storage," page 31.)

Tires

During winter storage it is best to remove the tires from the rims and keep the casings and tubes in a fairly warm atmosphere away from the light. It is best to inflate the tubes slightly after the tires have been removed to keep the tires in the position in which they are when inflated on the rim.

If the tires are not removed from the car, and the car is stored in

a light place, it is best to cover the tires to protect them from strong light, which has a deteriorating effect on rubber.

The greatest injury that can be done to tires when the car is stored is to allow the weight of the car to rest on them. If the tires are not removed the car should be blocked up so that no weight is borne by the tires and the tires partly deflated.

Body and Top

It is best to put the top up and cover the entire car to protect it from dust.

Taking Car Out of Storage

When the car is taken out of storage the following directions should be followed carefully in starting the engine:

Open the compression cocks and inject from one to two tablespoonfuls of clean fresh engine oil into each cylinder.

Close the compression cocks and with the ignition turned off turn the engine over slowly a few revolutions by hand.

If the engine is to be started by hand cranking, place the spark lever at the extreme left of the spark and throttle sector. If the starter is to be used, place the spark lever on that portion of the sector marked "Driving Range." Open the gasoline valve at the tank and start the engine in the usual manner.

Immediately the engine starts, run it at a speed which will show an ammeter reading of approximately 10 with all lights switched off, and push the auxiliary air lever down as far as possible without causing the engine to stop, or a material reduction in engine speed.

With the engine running, inject from two to three tablespoonfuls of clean fresh engine oil into the primary air inlet at the right-hand side of the carburetor.

Push the auxiliary air valve lever all the way down as soon as the engine is warm enough to permit it.

ELECTRICAL SYSTEM

GENERAL DESCRIPTION

The Cadillac-Delco system is the single wire, single unit system. One side of the motor generator, storage battery, lamps, horn and ignition apparatus is connected to some part of the frame of the car or the engine. The other connections are made with copper wires or cables.

MOTOR GENERATOR

The motor generator serves both as a generator of current and as an electric motor for cranking the engine when starting. The principal

elements of the motor generator are an armature and a field. There are two windings on the armature and two in the field—one on the armature and one on the field are used when the motor generator is used as a generator and the other windings when it is used as a motor.

Generator

The motor generator, when acting as a generator, is driven at engine speeds by the fanshaft which, in turn, is driven by a silent chain from the camshaft at the front end of the engine. Thus driven, it delivers electrical energy for charging the storage battery and for operating the lights, ignition apparatus and horn. To prevent the voltage of the current generated from rising too high when the engine is running at high speeds, the third brush system of current regulation is employed.

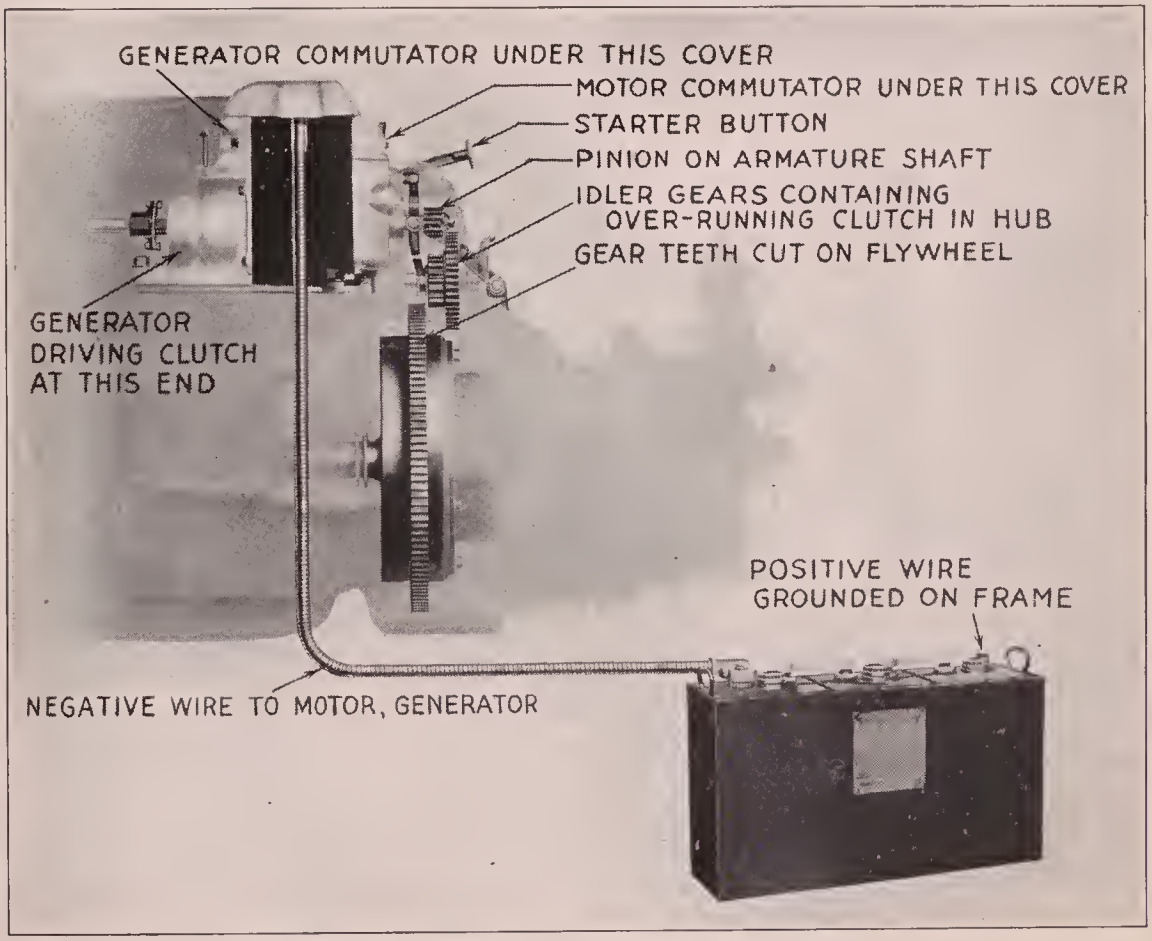

GENERATOR COMMUTATOR UNDER THIS COVER
MOTOR COMMUTATOR UNDER THIS COVER
STARTER BUTTON
PINION ON ARMATURE SHAFT
IDLER GEARS CONTAINING OVER-RUNNING CLUTCH IN HUB
GEAR TEETH CUT ON FLYWHEEL
GENERATOR DRIVING CLUTCH AT THIS END
POSITIVE WIRE GROUNDED ON FRAME
NEGATIVE WIRE TO MOTOR, GENERATOR

Fig. 4—Motor Generator and Starting Mechanism.

Motor

When acting as a motor, the sole function of the motor generator is to crank the engine. In starting, the first thing the operator does is to push down the ignition lever on the combination switch. This

closes the ignition circuit and the circuit between the storage battery and the generator windings on the motor generator, causing the armature to revolve slowly.

A ratchet clutch in the front end of the generator allows the armature to rotate ahead of the driving shaft. The clicking noise that is heard when the ignition switch is turned on comes from this clutch.

Next the operator pushes down the starter button. The first movement causes the starter gears to mesh with the teeth on the flywheel. The probability of the ends of the teeth striking and failing to mesh is overcome by the slow rotation of the armature which began as soon as the ignition was turned on.

As the starter button is pushed further down, the circuit between the storage battery and the generator windings of the motor generator is broken. Upon the last movement of the starter button the circuit is closed between the storage battery and the motor windings on the motor generator, causing it to act as a powerful electric motor which rapidly cranks the engine.

As the gear ratio between the armature shaft and the crankshaft is approximately 25 to 1, the armature would be driven at an excessively high rate of speed after starting the engine and before the operator let the starter button back if it were not for an over-running clutch in the hub of the idler gears between the flywheel and the armature shaft. The electric motor cranks the engine through this clutch, but after the engine has started and begins to run faster than the electric motor, the clutch slips.

When the starter button is let up, as soon as the engine is running under its own power, the first movement of the button breaks the circuit between the electric motor and the storage battery, a further movement causes the starter gears to slide out of mesh and the final movement completes the circuit between the generator and the storage battery, which was broken when the starter button was pushed down. The engine running and the circuit being closed between the storage battery and the generator windings of the motor generator, the generation of current begins.

Commutators

Do not under any condition put oil of any kind on the commutators of the motor generator.

Fitting Motor Generator Brushes

If the brushes of the motor generator do not have a good full bearing on the commutators, the brushes should be refitted. To do so proceed as follows:

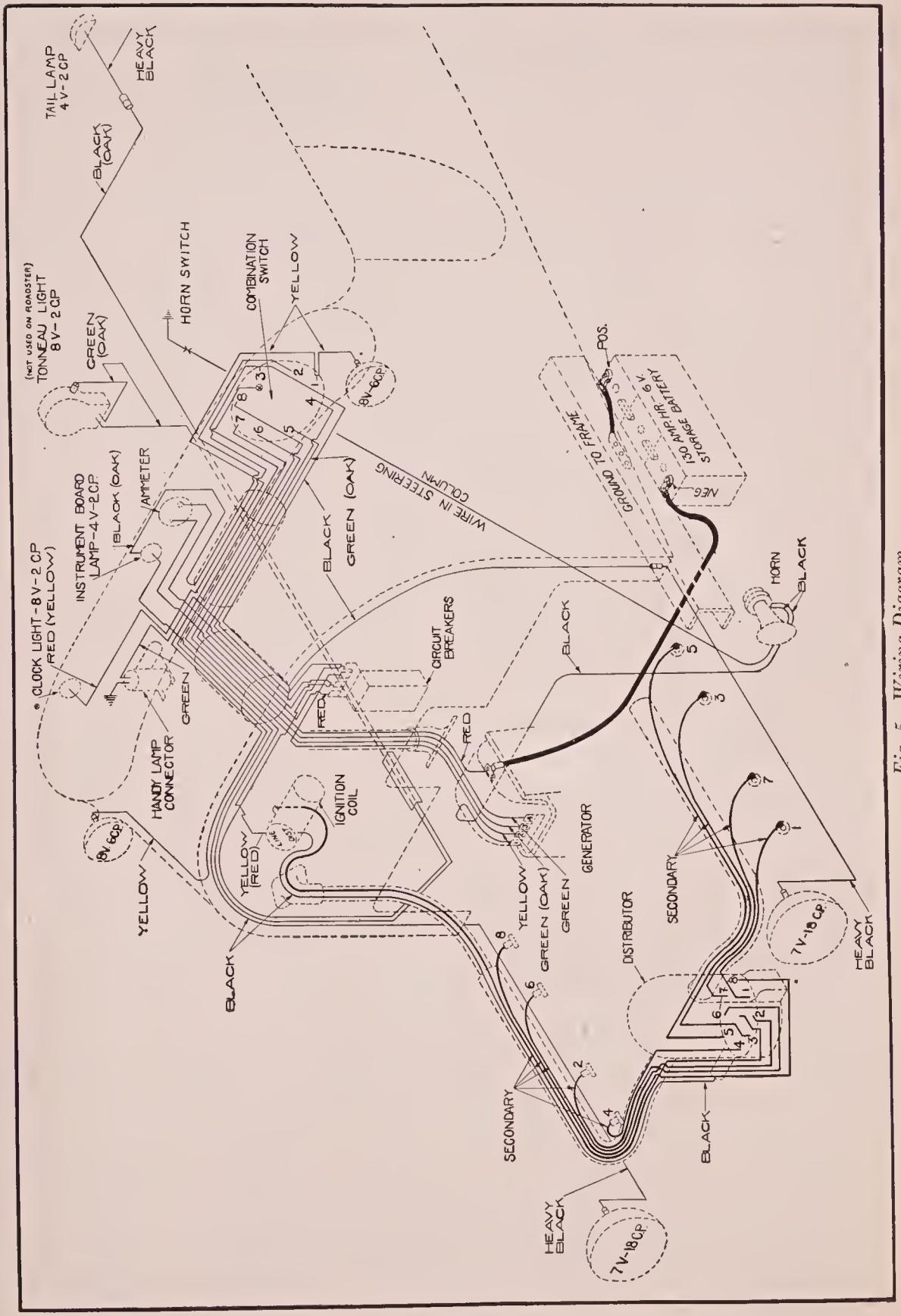


Fig. 5—Wiring Diagram.

Cut a strip of Number 00 sand paper slightly wider than the brushes. Pass it between the brushes and the commutator and at least one-half way around the commutator. Draw the sandpaper back and forth with sanded side against the brushes.

Do not use emery cloth in fitting the brushes.

LAMPS

Focusing Headlamps

The adjustment for focusing the headlamp bulb is near the top of the lamp and is accessible after removing the lamp door.

To make the adjustment, run the car head on towards, and at right angles to, a high fence or building, and stop when within from fifteen to twenty feet from it. Then, with the tilting reflector in the straight ahead position, change the adjustment until the bulb is in the proper position.

If in turning the screw to the right, the rays of light appear to spread out, it indicates that the bulb is too far back in the reflector and that it should be brought forward. To do this, turn the adjusting screw to the left until the proper rays are shown.

If the adjusting screw be turned to the left and the rays appear to spread out, it indicates that the bulb is too far forward and it should be brought back. To do this, turn the adjusting screw to the right until the proper rays are shown.

Cleaning Reflectors

The reflectors in the head and side lamps are plated with pure silver. In polishing, extreme care must be used in selecting materials which will not scratch the silver.

Powdered dry rouge and a chamois skin are recommended. If the reflectors are tarnished, moisten the rouge with alcohol, and apply with the chamois. Then polish with a dry chamois and rouge.

The chamois should be soft and must be kept free from dust. Do not use the chamois for any other purpose.

Lamp Bulbs

Bulbs should have the correct voltage and candle power rating. The following is a table of voltage and candle power ratings:

Lamps	Voltage	Candle Power
Head	7	18
Side	8	6
Speedometer	4	2
Tail	4	2
Clock	8	2
Tonneau	8	2
Portable	8	6
Dome, enclosed cars	8	6
Quarter, enclosed cars	8	2

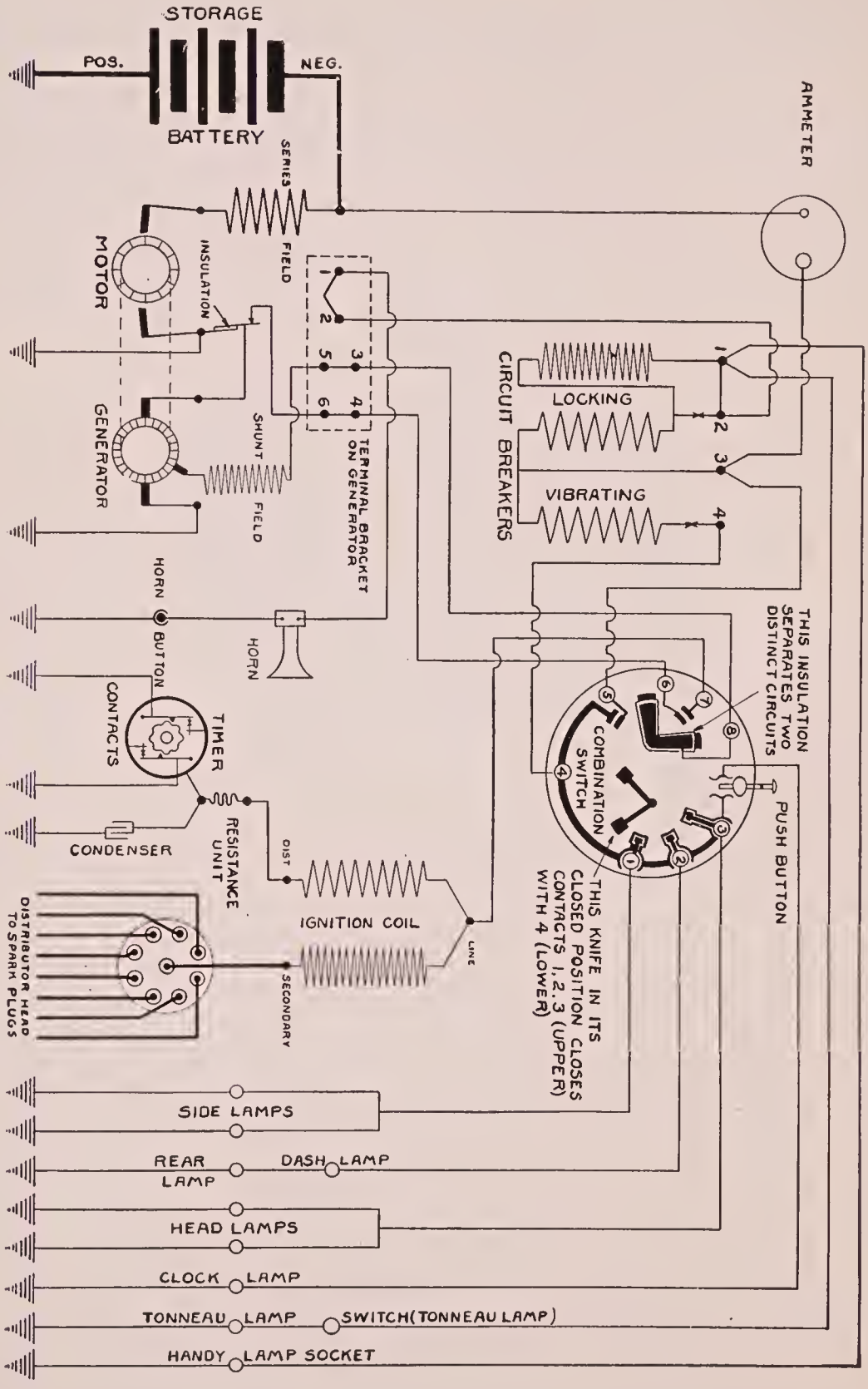


Fig. 6—Circuit Diagram.

IGNITION SYSTEM

General Description

The ignition system embodies the following elements: A source of current, the generator, or at low speeds, the storage battery; an ignition timer, which interrupts the low tension current at the proper instant to produce a spark in the high tension circuit; an induction coil, transforming the primary current of six volts into one of sufficient voltage to jump between the points of the spark plugs; a condenser, which assists the induction coil to raise the voltage, and which protects the contact points of the ignition timer from burning; and a high tension distributor which directs the distribution of the high tension current to the spark plugs in the respective cylinders.

Distributor and Timer

The distributor and timer, Fig. 34, are carried on the fanshaft housing and are driven by the fanshaft through spiral gears.

The distributor consists of a cap or stationary head of insulating material and a rotor of the same material which turns with the timer shaft. The distributor head carries one contact in the center and eight additional contacts placed at equal distances about the center. (Only two of these contacts are shown in Fig. 34.) The center contact is connected to the high tension terminal on the ignition coil. The eight remaining contacts are connected to the spark plugs in the cylinders. The center contact is provided with a spring plunger which is in constant communication with a plate on the rotor. This plate carries at its outer end a contact button. As the rotor revolves, the contact button slides over the eight outer contacts in the distributor head, consecutively completing the high tension circuit to each of the spark plugs from the ignition coil.

The timer, by which the low tension current is interrupted at the proper time to produce the spark, is beneath the rotor. An eight lobed cam "J," Fig. 7, on the timer shaft, operates two contact arms "C" and "O." As the cam revolves, these arms alternately complete and break the primary circuit. The cam is held in place by the lock screw "I."

Two sets of timer contact points are provided. The object is to distribute over two sets the current which would otherwise pass through one. This greatly lessens wear and burning of the points.

The spark timing is automatically controlled by a centrifugal governor which advances or retards the position of the timer cam relative to the driving shaft, as the engine speed increases or decreases. A spark lever at the steering wheel is provided, however, by which the timing may be still further advanced or retarded. This spark lever is connected to the manual control lever at the left of the distributor housing.

Cleaning Distributor Rotor Button Track

If the track in the distributor head, against which the rotor button presses, requires cleaning, do not use sandpaper or emery cloth. Clean with a piece of cloth moistened with vaseline, then polish with a dry cloth.

Adjustment of Timer Contact Points

Remove the distributor rotor (see "Removal" under "Distributor Rotor," page 99).

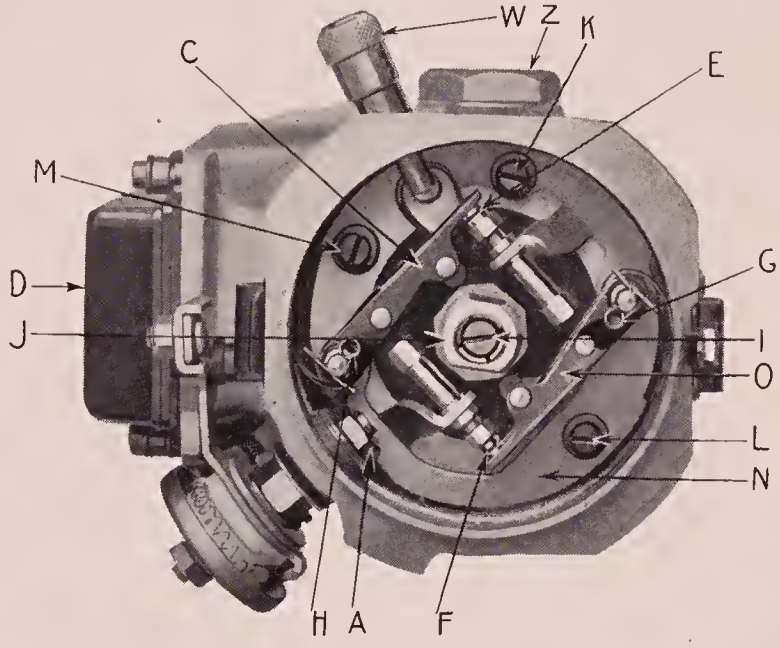


Fig. 7—Timer.

Crank the engine by hand until the contact arms "O" and "C," Fig. 7, are directly on top of lobes of the cam "J." Then adjust the contact points at "E" and "F" so that they stand twenty thousandths of an inch apart. Both sets of contact points should be adjusted exactly alike.

DO NOT FILE OR GRIND THE CONTACT POINTS. To clean the points remove them and simply rub them over an oil stone two or three times. Then replace and adjust, following instructions given.

It is a good plan, after adjusting the timer contact points, to check the ignition timing. (See under "Timing Ignition," on this page.)

Timing Ignition

Unless the timer contact points are in proper adjustment they should be readjusted before proceeding to time the ignition.

To time the ignition proceed as follows:

Move the spark lever to the extreme left on the sector; open the compression relief cocks on the cylinder blocks, and crank the engine

by hand until the piston in number one cylinder is on firing center. (Number one cylinder is the one nearest the radiator in the left-hand block of cylinders).

Next remove the distributor head, also the rotor (see "Removal" under "Distributor Rotor," page 99), and loosen the lock screw "I," Fig. 7, just enough to allow the cam "J" to be turned by hand after the rotor is fitted. (The lock screw should not be loosened enough to allow the cam to turn on the shaft when the engine is cranked by hand.)

Then replace the rotor and turn it by hand until the distributor brush in the rotor is directly under the terminal marked "No. 1" on the distributor head.

Replace the distributor head, and move the spark lever to the extreme right on the sector. (Full advance.)

Then switch on ignition; hold the high tension wire to the spark plug in number one cylinder about one-eighth of an inch away from the cylinder casting and crank the engine slowly by hand in the direction in which it runs. Stop cranking immediately a spark occurs between the wire and the casting. (It will be necessary to crank the engine nearly two complete revolutions before the spark occurs.)

If the cam "J" is properly set, a spark will occur when a point on the flywheel one and twenty-one thirty-seconds inches in advance of the center line for number one cylinder is directly under the pointer attached to the crankcase of the engine. This point for each cylinder is marked on the flywheel by the letters "I G A." (See Fig. 2.)

If the spark occurs before this, rotate the cam "J" slightly in a counter-clockwise direction to correct the adjustment. If the spark occurs later than this, rotate the cam slightly in a clockwise direction.

After the adjustment has been properly made, lock the cam securely to the distributor shaft by the lock screw "I."

After locking the adjustment it is a good plan to check the timing by fully retarding the spark lever; in other words, moving it to the extreme left on the sector, holding the high tension wire to the spark plug in number one cylinder about one-eighth of an inch away from the cylinder casting, and again cranking the engine slowly by hand in the direction in which it runs, stopping immediately a spark occurs. If the ignition is set properly the spark will occur under these conditions when the center line on the flywheel for number one cylinder is directly under the pointer attached to the crankcase, or has passed the pointer.

CAUTION—Do not set the ignition so that the spark occurs before center with the spark lever at the extreme left on the sector.

Resistance Unit

The resistance unit is a coil of resistance wire wound on a porcelain spool as shown in Fig. 7. Under ordinary conditions it remains

cool and offers little resistance to the passage of current. If for any reason the ignition circuit remains closed for any considerable length of time with the engine not running, the current passing through the coil heats the resistance wire, increasing its resistance to a point where very little current passes, and insuring against a waste of current from the battery and damage to the ignition coil and timer contacts.

Ignition Condenser

The purpose of the condenser in the ignition system is to protect the timer contact points against the corrosive action of sparking and to utilize the tendency to spark to build up a higher voltage in the high tension circuit than would otherwise be obtained.

The ignition condenser is mounted on the right-hand side of the distributor housing in a waterproof casing "D." (See Fig. 7.) It consists of layers of tinfoil separated by sheets of paraffin paper. Alternate layers of tinfoil are connected to opposite terminals. The current does not pass through the condenser and on test the terminals should show open circuit.

There are no adjustments in connection with the condenser.

Ignition Coil

The ignition coil serves to transform the low voltage current in the primary circuit to a current of high voltage in the secondary circuit. The coil consists of a primary winding of coarse wire wound around an iron core in comparatively few turns, and a secondary winding of many turns of fine wire, also the necessary insulation and terminals for wiring connections.

Spark Plugs

In order to get the best results the porcelains of the spark plugs should be clean and the points should be .023 inch apart. If the points are too close, the engine will miss under a light load and when idling. If the points are too far apart, it will miss under heavy loads and when the throttle is opened quickly for acceleration.

CIRCUIT BREAKERS

The circuit breakers are mounted on the inner face of the dash. These are protective devices which take the place of fuses.

The circuit breakers prevent the discharging of the storage battery, damage to the wiring to the horn, lights and the ignition apparatus, or to any of these parts in case any of the circuits to or in these parts become grounded.

As long as only a normal amount of current is used for horn, lights and ignition the circuit breakers will not open. In the event of a ground, an abnormally heavy current is conducted through one of

the circuit breakers, thus producing strong magnetism which attracts the armature and opens the contact. This cuts the flow of current.

The circuit breaker protecting the horn, handy lamp and tonneau lamp circuit is known as a lockout circuit breaker. In case of a ground in any of these circuits, the breaker opens and remains open until the ground is removed.

The circuit to the ignition apparatus and remainder of the lights is protected by a vibrating circuit breaker. In case of a ground in any of the circuits protected by the vibrating circuit breaker, the breaker will start to vibrate and will continue to vibrate until the ground is removed.

GENERATION OF CURRENT

Ammeter

When the engine is not running and the lights are turned on, the ammeter, which is located on the instrument board, indicates on the "Discharge" side of the dial the amount of current being drawn from the storage battery for this purpose. When the ignition switch is turned on the ammeter indicates, in addition, the current used in slowly rotating the armature of the motor generator. When the starter button is pushed down current is no longer required for slowly rotating the armature of the motor generator. The ammeter then indicates only the current used for the ignition and lights (if turned on). The ammeter does not indicate the amount of current used in the cranking operation.

Before the engine is running fast enough to generate sufficient current to equal the current demand, the ammeter indicates on the "Discharge" side the amount of current being drawn from the storage battery. When the engine has attained a speed sufficient to generate current to more than equal the demand, the ammeter indicates on the "Charge" side the excess current which passes to the storage battery and recharges it.

Ordinarily, with all lights switched off, sufficient current is generated to start recharging the battery when the car is operated in high gear at speeds between four and six miles per hour and, of course, at much lower speeds when the car is operated in low or intermediate gear. With all lights turned on sufficient current is generated to take care of the requirements at a speed of ten to fifteen miles per hour and at speeds greater than this the surplus current passes through the storage battery and recharges it. In other words, the ammeter indicates the rate at which the storage battery is being charged or discharged.

To determine the total output of the generator, turn off all the lights

and add the amount of current used for ignition, i. e., two to three amperes, to the ammeter reading.

Current Regulation

The generating capacity of the generator is regulated by means of a third brush on the generator commutator. (See Fig. 31.) The position of this brush relative to the other two generator brushes determines the maximum output of the generator, the length of the brush arm being adjustable. The brush arm is properly adjusted when the car is assembled and should not require readjustment unless its position is altered. To determine whether readjustment is necessary, proceed as follows:

Start the engine in the usual manner. With all the lights turned off slowly increase the speed of the engine by means of the hand throttle lever, meanwhile observing the hand of the ammeter on the instrument board. (*Do not race the engine.* There is no worse abuse, and it is unnecessary in this adjustment to run the engine faster than 1500 revolutions per minute.) The current indicated by the ammeter will increase with the speed of the engine to a point between 950 and 1200 revolutions per minute, and will then decrease. If the amount of current indicated by the ammeter at the maximum point is greater than 18 amperes, stop the engine and readjust the third brush as follows:

Remove the generator front end top cover. Loosen the two screws which hold together the two parts of the third brush arm and shorten the brush arm. After moving the third brush to an approximately correct position, press the brush down so that it makes even contact with the commutator, and hold it down while tightening the screws in the brush arm. The purpose of this is to have the curvature of the end of the brush conform as closely as possible to that of the commutator.

After setting the third brush, refit it to the commutator. (See "Fitting Motor Generator Brushes," page 18).

Start the engine. Again slowly accelerate the engine and check the maximum current. If it is still greater than 18 amperes, reset the third brush and sand it in again.

If the maximum current indicated by the ammeter is less than 18 amperes and the specific gravity of the battery repeatedly shows that the battery is not being properly charged, lengthen the brush arm. Do not, however, lengthen the brush arm unless the condition of the battery makes it necessary and under no circumstances adjust it so that the ammeter indicates a maximum current of more than 18 amperes with all lights turned off. A greater amount of current may result in serious injury to the motor generator.

STORAGE BATTERY

Adding Water to Storage Battery

The acid solution in the storage battery must cover the plates, and should be even with the bottom of the filling tubes. (See Fig. 8.) Add water to bring up the level. Do not add acid.

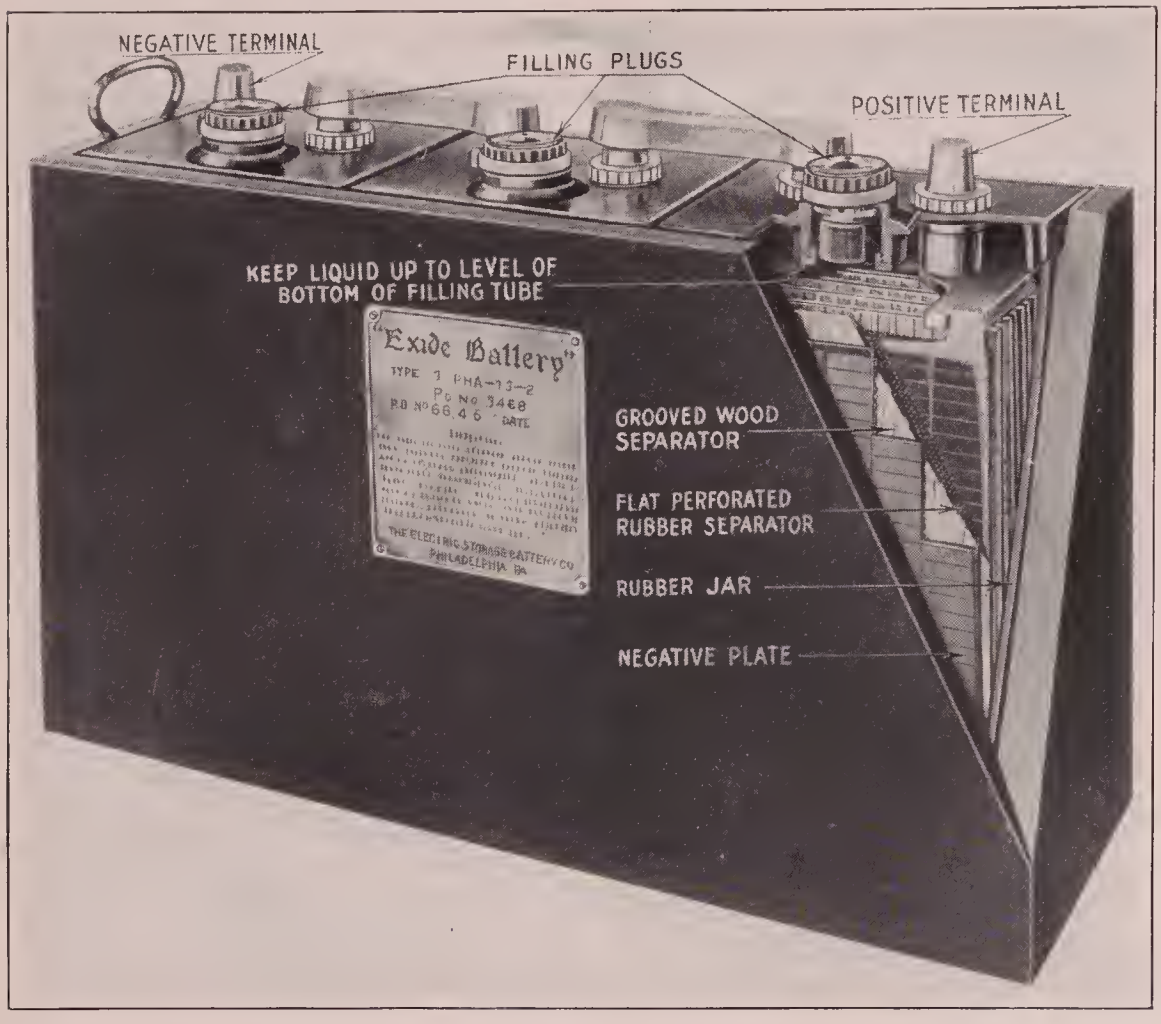


Fig. 8—Storage Battery, Sectional View.

To remove a filling plug, turn it as far as possible in the counter-clockwise direction, then lift it straight up. To replace, hold it so that the large arrow is perpendicular to the center line of the car, set the plug in place and turn it in the clockwise direction until tight.

Water for filling the battery must be pure. Distilled water, melted artificial ice or fresh rain water are suitable for this purpose. If rain water is used, it should not be allowed to come in contact with any metal. It should not be caught from a metal roof or in a metal receptacle.

Never keep the water in a metal container, such as a metal bucket or can. It is best to get a bottle of distilled water from a druggist or

from an ice plant. The whole point is to keep metal particles out of the battery. Spring water, well water or hydrant water from iron pipes generally contains iron and other metals in solution, which will ultimately cause trouble if used.

Replacing Acid Lost by Spilling

If any acid solution has been spilled or has leaked from a cell, replace the loss with freshly mixed solution and follow with an overcharge by running the engine for several hours or by charging the battery from an outside source. (See Fig. 9. Also see under "Personal Danger of Running Engine in Closed Garage," page 39.)

The specific gravity of the acid solution used for replacing the loss should be the same as that of adjacent cells. This can be determined by the use of an hydrometer syringe.

The acid solution may be prepared by mixing chemically pure sulphuric acid, which has a specific gravity of 1.840, and distilled water. The proportion for an acid solution having a specific gravity of 1.280 is one part of chemically pure acid and three parts (by volume) of distilled water. *The acid must always be poured slowly into the water. Do not pour the water into the chemically pure acid.*

If, after mixing the acid solution as described above, a solution of a lower specific gravity is desired, it may be prepared by adding additional water to the mixture. But do not under any conditions pour water into the chemically pure acid.

Charging from an Outside Source

It is necessary that the charging be done with *direct current.* The simplest method when there is 110 or 120 volt direct current available, is to connect eight 110 volt, 32 candlepower, 100 watt carbon lamps in parallel with each other and in series with the battery to be charged, this combination giving approximately the proper charging rate—8 amperes. The positive terminal of the battery must be connected to the positive side of the charging circuit and the negative terminal to the negative side. *Very serious injury to the battery will result if connected in the reverse direction.* The terminals of the battery are stamped "Pos." and "Neg."

To determine the polarity of the charging circuit, if a suitable voltmeter is not at hand, dip the ends of the two wires "A" and "B" (Fig. 9) into a glass of water in which a teaspoonful of salt has been dissolved, care being taken to keep the wires at least an inch apart. When the current is turned on, fine bubbles of gas will be given off from the negative wire.

The diagram (Fig. 9) illustrates just how the connection should be made. The charge should be continued until all the cells have been

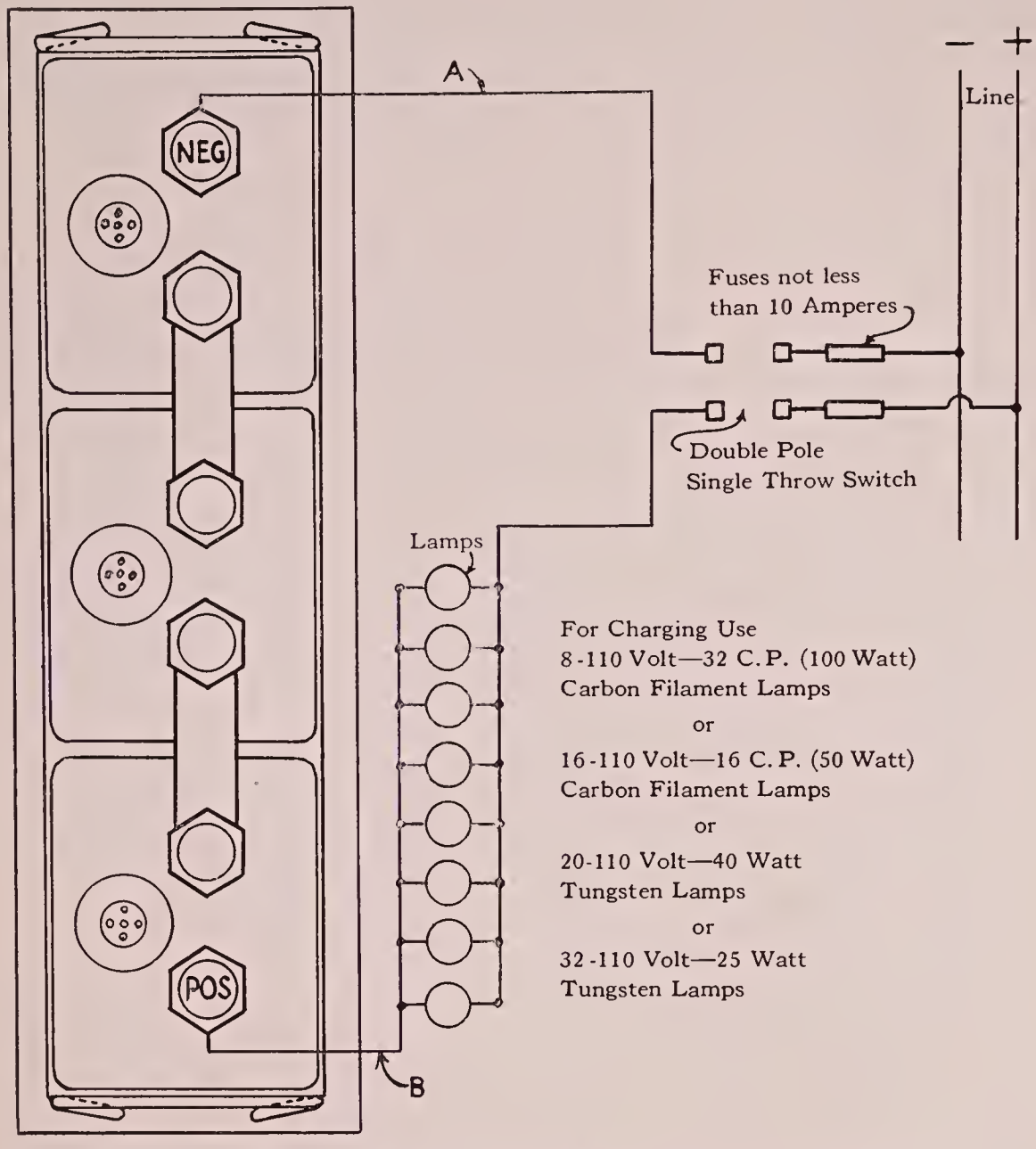


Fig. 9—Diagram of Connection for Charging Battery from 110 Volt D. C.

"gassing" or bubbling freely for five hours, and there is no further rise in the voltage of the battery or specific gravity of the acid solution over the same period. A battery in good condition in a discharged state will require about ten hours of re-charging. If it has stood in a discharged condition for several weeks, it will require from twenty-five to fifty hours' charging—all depending upon the condition of the battery and the length of time it has stood discharged.

If only alternating current is available, a current rectifier must be used. Consult your city electrician regarding this matter.

CAUTION—Never run the engine with the storage battery discon-

nected, or while it is off the car. Very serious damage to the motor generator may result from such action.

Preparing Battery for Storage

When a car is stored for some time the level of the acid solution should be even with the bottom of the filling tubes. (See under "Adding Water to Storage Battery," page 28.) If water is added it should be added just before the last time the car is used so that it will be thoroughly mixed with the acid solution. When the car is stored, the specific gravity of the acid solution should register from 1.270 to 1.290. In this condition there is no danger of the acid solution freezing during cold weather. The specific gravity of water is 1.000 and water freezes at 32 degrees F. above zero.

Unless the battery is fully charged, or nearly so, during freezing weather, it is probable that the acid solution in the battery will freeze and cause extensive damage.

The following is a table of the freezing temperatures of sulphuric acid and water solutions of specific gravities from 1.050 to 1.300:

Specific Gravity (Hydrometer Reading)	Freezing Temperature (Degrees Fahr.)
1.050	+27°
1.100	+18°
1.150	+ 5°
1.164	0°
1.200	—17°
1.250	—61°
1.275 to 1.300	—90°

The battery should be charged every two months during the "out of service" period, either by running the engine or charging from an outside source (Fig. 9). If neither of the above is possible, the battery can be allowed to stand without charging during the winter provided the specific gravity of the acid solution registers from 1.270 to 1.290 at the time the car is laid up. Much better results and longer life from the battery will be obtained by giving the periodic charges.

The wires of the battery should be disconnected during the "out of service" period, as a slight leak in the wiring will discharge the battery.

Placing Battery in Service Again

Before putting the battery into service again, inspect it and add water, if necessary. In placing the battery on the car, care should be taken not to tighten the hold-down bolts too tight. If the battery has not been kept charged during the winter, it will be advisable to give it a fifty-hour charge at a four-ampere rate from an outside

source before putting it into service again. Make sure that the terminals are free from corrosion and that good connections of the wires are made.

The corrosion, which is a greenish deposit, can be removed from the bolts and terminals by placing them in a solution of water and bicarbonate of soda (cooking soda).

The corrosion can be removed from the posts by saturating a piece of cloth with the solution and wiping them off. Do not allow any of the solution to get into the cells of the battery.

After the parts are free from corrosion they should be washed in warm water, and a light coat of heavy grease or vaseline applied.

If the battery has received periodic charges, it will not be necessary to give it any special attention other then to fill it to the proper height with distilled water. After the car has been driven for a number of hours, read the specific gravity of the acid solution with the hydrometer syringe. It should register from 1.270 to 1.290 if the battery is fully charged.

Sediment

The sediment which gradually accumulates in the bottom of the jars should be removed before it reaches the bottom of the plates, as it is very harmful to the battery. The need of cleaning may be determined by inspection. Its necessity is indicated by lack of capacity, excessive evaporation of the acid solution and excessive heating when charging. When a battery requires removal of sediment, better results follow if the work is done at a place where they are thoroughly familiar with storage battery practice.

Exide Depots and Sales Offices

The Electric Storage Battery Company, whose general offices and works are at Alleghany Avenue and 19th Street, Philadelphia, Pa., has service stations in towns of any considerable size where battery repair work is done, as well as sales offices and Exide battery depots in a number of the larger cities of the country where complete assembled batteries and repair parts are carried in stock. For the location of the nearest Exide depot or service station write the Electric Storage Battery Company, at Philadelphia.

COOLING SYSTEM

ANTI-FREEZING SOLUTION

The radiator condenser makes it possible to use with safety an anti-freezing solution of denatured or wood alcohol and water. Do not use a solution containing calcium chloride, as this is injurious to the metal parts of the cooling system.

The capacity of the cooling system is five and one-quarter gallons. The condenser should contain an additional three quarts, making a total of six gallons.

The following are the freezing temperatures of denatured alcohol and water solutions of various proportions.

Denatured Alcohol (% by volume)	Water (% by volume)	Freezing Temperature (degrees Fahr.)	Specific Gravity (Hydrometer reading)
20%	80%	+13°	.974
30%	70%	— 3°	.964
40%	60%	—20°	.953
50%	50%	—34°	.936

It is a good plan occasionally to draw out a sample of the solution in the radiator and to test its specific gravity with a hydrometer graduated between the limits of the above table.

CAUTION—Don't put water into the cooling system during freezing weather. Use a good anti-freezing solution. Water will freeze even though the engine be run continuously.

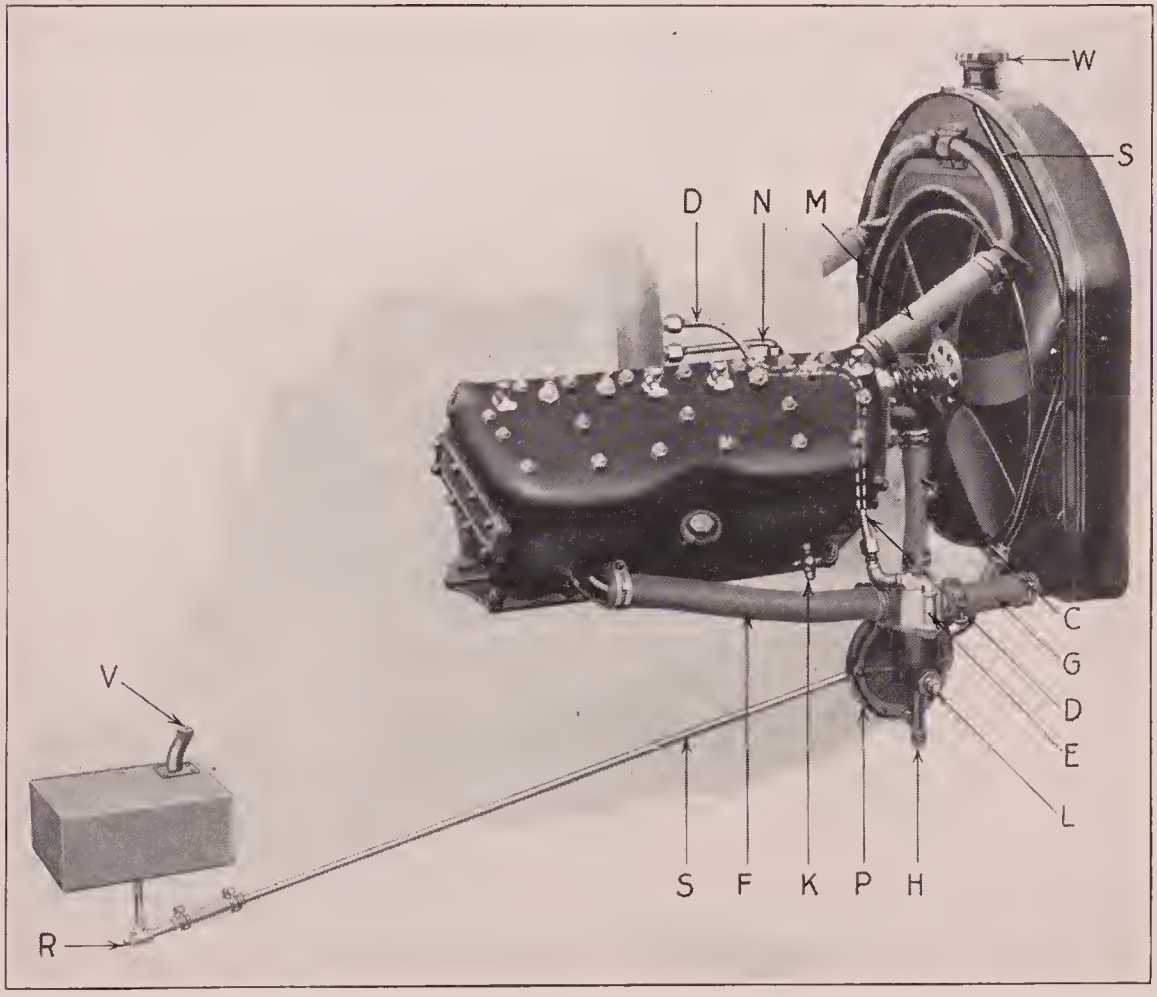


Fig. 10—Cooling System.

FILLING AND DRAINING THE COOLING SYSTEM

Filling the Cooling System

Fill the cooling system with clean water, during warm weather, and with a suitable anti-freezing solution during freezing weather. (See under "Anti-Freezing Solution.")

To fill the cooling system after it has been drained, replace the drain plugs "H," Fig. 10, in the water pumps, close the drain cocks "K" in the cylinder blocks and turn the shafts "L" on the water pumps so that the indicators on the ends of the shafts point up. The shafts may be turned in either direction.

Then remove the filler cap "W" from the top of the radiator and fill the cooling system. Replace the filler cap and *screw it down firmly.* This is necessary, to insure the proper operation of the condenser.

After the cooling system is filled, turn the shafts "L" on the water pumps so that the indicators on the ends of the shafts point down. These indicators should point up when filling or draining the cooling system and down at all other times.

The cooling system should be full or nearly so. When it is necessary to add only a small amount of liquid to bring up the level, it is not necessary to turn the shafts "L" on the water pumps, but simply to remove the radiator filler cap.

When the cooling system is cold, the condenser should be one-half full of the same liquid as used in the radiator. To add liquid to the condenser, take up the removable floor board and remove the filler cap "V" at the top of the condenser. Any excess liquid which may accumulate in the condenser should be drained off at "R," Fig. 10, and poured back into the radiator.

Draining the Cooling System

To drain the cooling system, remove the drain plugs "H," Fig. 10, from the water pumps and turn the shafts "L" on the water pumps so that the indicators on the ends of the shafts point up. The shafts "L" may be turned in either direction. Then open the drain cocks "K" in the cylinder blocks.

To drain the condenser remove the drain plug "R" in the pipe leading from the bottom of the condenser.

CLEANING THE COOLING SYSTEM

Run the engine with the radiator covered until the liquid in the cooling system is boiling hot. Then turn the shafts "L," Fig. 10, on the water pumps so that the indicators on the ends of the shafts point up.

Shut off the engine and immediately remove the drain plugs "H" from the water pumps and open the drain cocks "K" in the cylinder

blocks. (Bear in mind in removing the drain plugs "H" that the liquid is scalding hot.) Remove the drain plug "R" in the pipe leading from the bottom of the condenser.

If an alcohol anti-freezing solution is drawn off, part of it may be used again if the sediment is allowed to settle. In case it is used again its specific gravity should be tested with an hydrometer, after it has thoroughly cooled.

When the liquid has drained off, replace the drain plugs "H," close the drain cocks "K" and fill the cooling system with clean, hot water. Then repeat the operations outlined above.

If in draining the second time, the water is very dirty, it may be desirable to repeat the flushing operation a third time, using a solution of sal-soda. If the sal-soda solution is used, be sure that it is drained out and the cooling system flushed again with clear water.

The sal-soda solution should not be allowed to get on the finish of the hood or radiator.

During freezing weather be sure to refill with a suitable anti-freezing solution.

WATER PUMPS

Water Pump Packing Glands

To tighten the glands of the water pumps first remove the splash pan under the engine, then turn the packing gland "O," Fig. 27, in the direction in which the wheels rotate when the car is moving backward.

To repack water pumps it is necessary to first remove them. (See "Removal of Pump" under "Water Pumps," page 80). Repack with Cadillac packing.

In tightening the glands, tighten them only sufficiently to prevent leakage. Tightening them further causes unnecessary friction on the pump shaft.

Strainers

The strainer in each radiator outlet must be clean. To remove, see "Removal" under "Water Pump Strainers," page 104.

Adjustment of Thermostat Valves

The thermostat valves "C," Fig. 27, are screwed onto the threaded stem of the thermostatic member "D" and are held in place by a slotted nut "M" in the center of the valve. The valves are adjusted when the car is assembled and no further attention should be required. In the event that the adjustment has been altered, proceed as follows in making a readjustment:

Drain the cooling system. (See under "Draining the Cooling System," page 34.) Disconnect the hose "B" and the pipe "A" at the pump. Remove the four small screws in the cap to which the hose and pipe were attached and remove the cap.

Turn the shaft "L" so that the indicator on the end of the shaft points in a *horizontal* direction. With a screw-driver loosen the slotted locking nut "M". Then adjust the valve until it just seats without placing any tension on the thermostatic member "D." Hold the valve in this position and tighten the slotted adjusting nut.

Replace the cap and connect the hose "B" and the pipe "A." Turn the shaft "L" so that the indicator points up and fill the cooling system. After filling the cooling system, turn the indicator down, regardless of weather conditions.

GASOLINE SYSTEM

PRESSURE RELIEF VALVE

A pressure relief valve is connected in the air line of the gasoline system for the purpose of preventing excessive pressure. It is attached to the left-hand side of the frame under the front floor boards and is adjusted to release if a pressure of four pounds should be reached. As the pump at the front of the engine is designed to furnish a pressure of considerably less than four pounds, it is evident that the relief valve is not intended to release under normal conditions. The relief valve is intended to operate only in case higher pressures result from the use of gasoline, such as "casing-head" gasoline, containing highly evaporative fractions.

If the pressure gauge on the instrument board shows a pressure of more than four pounds the relief valve should be readjusted. Or, if it is found impossible to maintain sufficient pressure to insure flow of fuel to the carburetor, this condition may indicate need for readjustment of the valve.

As low pressure may also be caused by leakage of air at the gasoline tank filler cap or at the piping connections, or by the presence of dirt on the needle valve "D," Fig. 11, or its seat, do not readjust the relief valve without making certain that the low pressure is due to the valve releasing and not to these other causes.

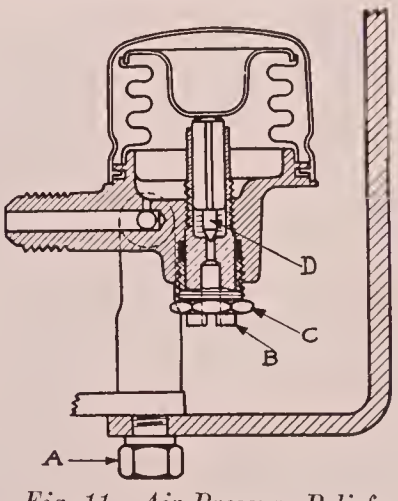


Fig. 11—Air Pressure Relief Valve, Sectional View.

To readjust the pressure relief valve remove the cap screw "A" by which the relief valve is attached to the side bar and spring the piping so that access may be had to the nut "C" and screw "B" underneath the relief valve. Loosen the hexagonal gland nut "C." Then turn the hollow, slotted screw "B" in the clockwise direction if the pressure at which the valve releases is too low; or in the counter-clockwise direction if the valve releases at too high a pressure. Tighten the gland nut "C."

Check the results of the adjustment by raising the pressure with the hand pump. (Less pumping will be required if the tank is full or nearly so.) If it is found possible to raise the pressure above four pounds on the gauge, or if the maximum pressure obtainable is less than four pounds, the adjusting screw "B" should be adjusted again.

After the adjustment has been correctly made, make sure that the gland nut "C" is tight.

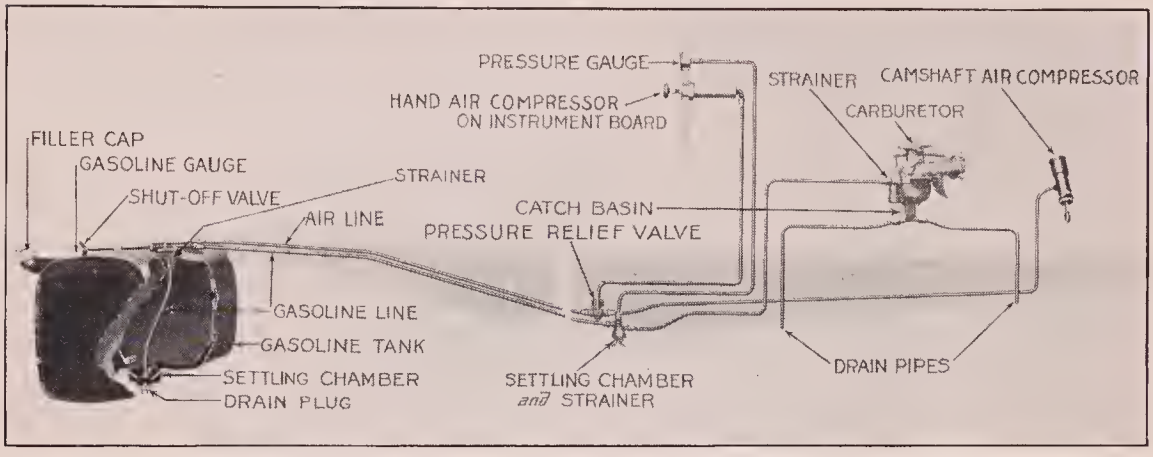


Fig. 12—Gasoline System.

SETTLING CHAMBERS AND STRAINERS

The gasoline system is protected by a settling chamber at the bottom of the gasoline tank, a strainer at the top of the tank, a strainer and a settling chamber under the front floor boards, and a strainer at the carburetor. These settling chambers and strainers must be clean.

CARBURETOR

Adjustment of Carburetor

The carburetor should not be tampered with unless it needs adjustment. Good carburetor action cannot be expected until the engine is thoroughly warmed up. This is particularly true during cold weather. Imperfect carburetor action while the engine is cold does not indicate that the carburetor requires adjustment, and carburetor adjustment should not be made under these conditions.

Before changing any of the carburetor adjustments be sure it is the carburetor which requires attention.

When it is certain that the carburetor requires adjusting, proceed as follows:

Method of Adjustment

Open the throttle about two inches on the sector at the steering wheel. Place the spark lever in the "Driving Range" on the sector and

start the engine. If the engine is cranked by hand the spark lever should be placed at the extreme left on the sector.

Run the engine until the water jacket on the intake manifold is hot.

Move the spark lever to the extreme left on the sector and the throttle lever to a position which leaves the throttle in the carburetor slightly open. Adjust the air valve screw "A," Figure 13, to a point which produces the highest engine speed. Turning the screw "A" in a clockwise direction increases the proportion of gasoline to air in the mixture, and vice versa.

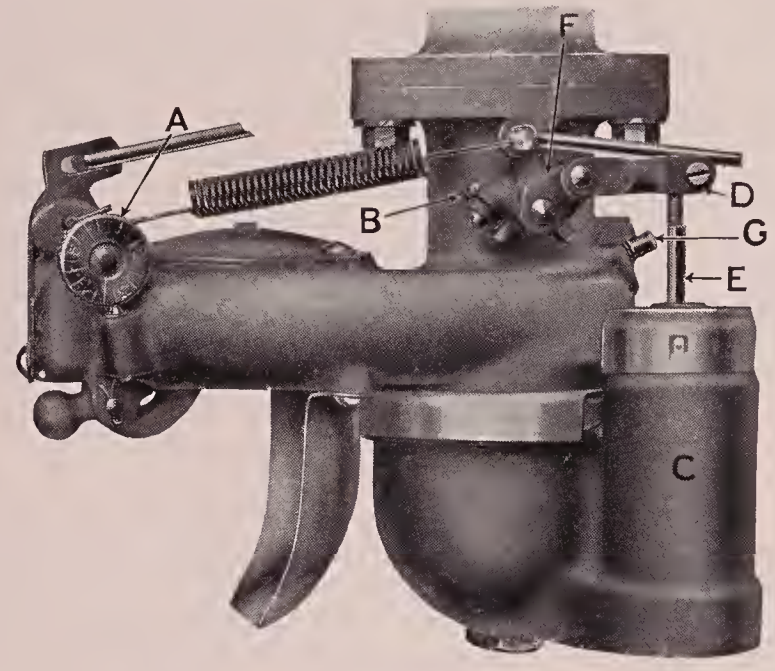


Fig. 13—Carburetor, Side View.

"Close" the throttle (move it to the extreme left on the sector) and adjust the throttle stop screw "B" to a point which causes the engine to run at a speed of about 300 revolutions per minute. The spark lever should be at the extreme left on the sector when this adjustment is made.

With the spark and throttle levers at the extreme left on the sector, adjust the air valve screw "A" to a point which produces the highest engine speed.

Open the throttle until the shutter attached to the right-hand end of the throttle shaft *just* covers the slot in the carburetor body. Then adjust the screw "G" to a point which produces the highest engine speed or to a point where the engine slows down slightly from a lean mixture. Turning the screw "G" in a clockwise direction increases the proportion of gasoline to air in the mixture, and vice versa.

In making the adjustment during very cold weather when a slightly richer mixture is desirable, it may be found best to turn the adjusting screw "G" further in a clockwise direction.

Setting of Carburetor Float

To determine if the float is set correctly, remove the carburetor from the engine and the float from the carburetor. (See under "Carburetor," page 105.) Hold the carburetor upside down. Under these conditions dimension "A," Fig. 36, should be ½ inch.

The setting may be corrected by bending slightly the arm to which the float is attached.

Throttle Pump

The rod "Y," Fig. 36, is adjusted at the factory and should require no further adjustment. If the adjustment is changed the rod should be readjusted so that its upper end is flush with the upper face of the arm to which it is attached.

Automatic Throttle

To determine if the spring which controls the automatic throttle is in proper adjustment, proceed as follows: Remove the carburetor. (See "Removal" under "Carburetor," page 105.) In the absence of the tool (No. 67327) furnished by the Cadillac Motor Car Company for making this test, bend a piece of No. 14 copper wire (.064 inch in diameter) 6⅞ inch long in the shape shown in Fig. 37, hooking it over the throttle as shown. With the carburetor in horizontal position, note the position which the throttle disc assumes. The disc should assume the horizontal position. If it does not, and you are sure that the throttle shaft is free in its bearings, slightly loosen the screws on the plate "X," Fig. 36, and turn the large adjusting cap. Turning the cap in a clockwise direction increases the tension of the spring and turning it in a counter-clockwise direction decreases the tension.

PERSONAL DANGER OF RUNNING ENGINE IN CLOSED GARAGE

Carbon monoxide, a deadly poisonous gas, is present in the exhaust of gasoline engines. Increasing the proportion of gasoline to air in the mixture fed to the engine, in other words, enriching it, increases the amount of carbon monoxide given off at the exhaust pipe.

Because of the presence of carbon monoxide it is very dangerous to run the engine for any length of time while the car is in a small, closed garage. If the doors and windows are open the danger is very much lessened, but it is far safer, particularly if an adjustment of the carburetor is being made, to run the car into the open.

Serious personal injury may be caused by the presence of carbon monoxide in a garage if the percentage of it in the air is greater than a very small fraction of one per cent. Unconsciousness may result without warning. It is reported that no indication of danger is given by personal discomfiture until too late. Deaths resulting from the presence of carbon monoxide in garages have been reported.

CLUTCH AND TRANSMISSION

CLUTCH

General Description

The main clutch is of the multiple disc dry-plate type. The eight driving discs, Fig. 39, are covered on both sides with a friction material, composed largely of asbestos, and are driven by gear teeth in the clutch ring which is bolted to the engine flywheel.

The nine driven discs are not covered. These discs are carried on the clutch hub and drive it through six keys on the hub. The clutch hub is keyed to the transmission shaft.

When the clutch is engaged by allowing the clutch pedal to come towards you, the spring forces all of the discs together. The resulting friction between the discs drives the transmission shaft and the car, when the transmission control lever is in other than the neutral position.

There are no adjustments on the clutch proper. The clutch pedal should be adjusted occasionally to compensate for wear on the facings of the clutch discs. This adjustment is explained under "Adjustment of Clutch Pedal Clearance," page 41.

Relining Clutch Discs

Remove the clutch discs in accordance with directions under "Removal of Clutch Discs," page 112.

Determine the amount of clearance between the teeth of the discs and the teeth of the clutch ring. If the clearance is .010 inch or more, new discs should be substituted.

With pliers or a sharp cold chisel and a hammer remove the used linings. Care must be exercised not to spring the discs in removing the linings.

After removing the lining determine if the discs are warped or sprung by laying them face down on a surface plate. If they are warped or sprung they should not be used again.

Cadillac clutch disc lining is supplied with the holes punched for the rivets. Suitable rivets are supplied. It is recommended that Cadillac lining and rivets be used.

Do not have the lining nearer than one-sixteenth of an inch from the bottom of the teeth on the periphery of the discs. Do not have the lining extend over the inner edge of the discs. Be sure that all rivets are well drawn in and headed over.

Do not have all rivet heads on one side of the disc. Alternate them. Rivets should be well drawn in and headed over.

CLUTCH PEDAL

Adjustment of Clutch Pedal Clearance

If the clutch pedal strikes the stop screw before the clutch is fully engaged, readjustment should be made.

Remove the pin "N," Fig. 14, and unscrew the yoke "P," which is threaded on the rod "O," so that when the pin "N," is replaced the clutch pedal has a movement back and forth of one and one-quarter inches without starting to release the clutch. Secure the pin "N" with a cotter pin and tighten the lock nut "V."

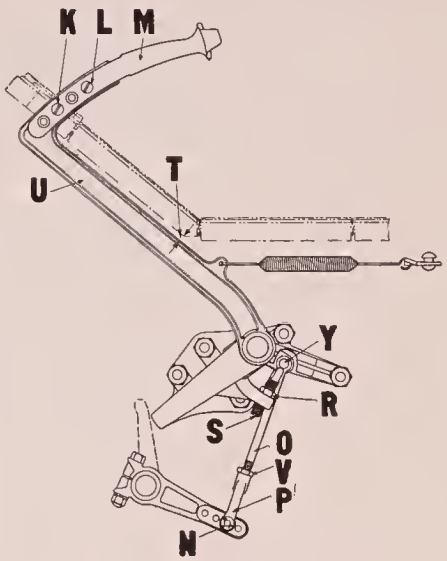


Fig. 14—Clutch Control.

Adjustment of Clutch Pedal Stop

The clutch pedal stop screw "S," Fig. 14, is adjusted when the car is assembled and requires no further attention. When in proper adjustment the stop screw "S" should hold the pedal arm "U" so that the distance "T" is approximately one-half inch on the Seven-Passenger, Two-Passenger, Four-Passenger and Victoria and approximately one-quarter inch on all enclosed cars except the Victoria. If the adjustment has been changed, it may be readjusted in the following manner:

Remove the pin "N" from the yoke "P," loosen the lock nut "R" and adjust the stop screw "S" so that the pedal arm "U" is held the required distance from the under side of the toe board at "T" when the pin "Y" is against the stop screw. Tighten the lock nut "R."

Then adjust the yoke "P" so that when the pin "N" is replaced the clutch pedal has a movement back and forth of one and one-quarter inches without starting to release the clutch. Secure the pin "N" with a cotter pin and tighten the lock nut "V."

Adjustment of Length of Clutch Pedal

To change the length of the clutch pedal, remove the bolts "K" and "L," Fig. 14, and slide the forked piece "M" in the desired direction. Do not pull "M" out so far that it is possible to put in only one bolt; two bolts are required properly to hold the parts.

There are four possible positions in this adjustment, Fig. 14 showing the extreme shortened position.

TRANSMISSION

General Construction

The transmission is of the selective type of sliding gear. It provides for three speeds forward and one reverse. The gear changes are accomplished by the movement of the control lever.

The teeth of the driving gear "A," Fig. 39, are cut on the large end of the clutch connection shaft "B" which revolves on annular ball bearings "C" and "D," and which turns with the crankshaft of the engine when the clutch is engaged, at which time the bearing "D" is inoperative. The gear "A" is in constant mesh with the jackshaft gear "E." The jackshaft gears "E," "F," "G" and "H" revolve together on two Hyatt high-duty flexible roller bearings "I" on a stationary shaft "J." The roller bearings "I" are lubricated by oil forced through the tube "K" which revolves with the gear "F."

The main transmission shaft "L," which is coupled to the forward universal joint, is splined and carries two sliding gears "M" and "N." The shaft "L" is supported by an annular ball bearing "O" at the rear end, and at the front end by a roller bearing "P" which is housed in the rear end of the clutch connection shaft "B."

There are no adjustments in the transmission.

UNIVERSAL JOINTS AND REAR AXLE

UNIVERSAL JOINTS

The tubular drive shaft that transmits the power of the engine from the transmission to the rear axle is fitted with a universal joint at each end.

The purpose of the joints is to provide a flexible drive, which is made necessary by the constantly changing alignment due to the play of the springs.

The general arrangement of the joints is shown in Fig. 40. The joints differ only in that the forward joint, which is attached to the transmission shaft, is provided with a sliding connection, or slip sleeve, "K," while the rear joint is welded to the drive shaft. A sliding connection is necessary to take care of the endwise motion of the drive shaft due to variation in the distance between the transmission and the rear axle caused by the action of the springs.

The joints are protected by an inner housing "D" and an outer housing "C," both of pressed steel. The inner housing is bolted to the flange and the outer housing fits over the end of the inner housing and is held in place and kept tight by means of a spring. The packing "H" is for the purpose of preventing grease from working out and dirt from getting in.

REAR AXLE

Adjustment of Gear and Pinion Bearings

In the design of the axle, provision is made for adjusting the pinion and gear so that the teeth may be correctly meshed, and for locking all the adjusting nuts in position securely.

The large bevel gear "A," Fig. 15, on the gear mount "B," and the

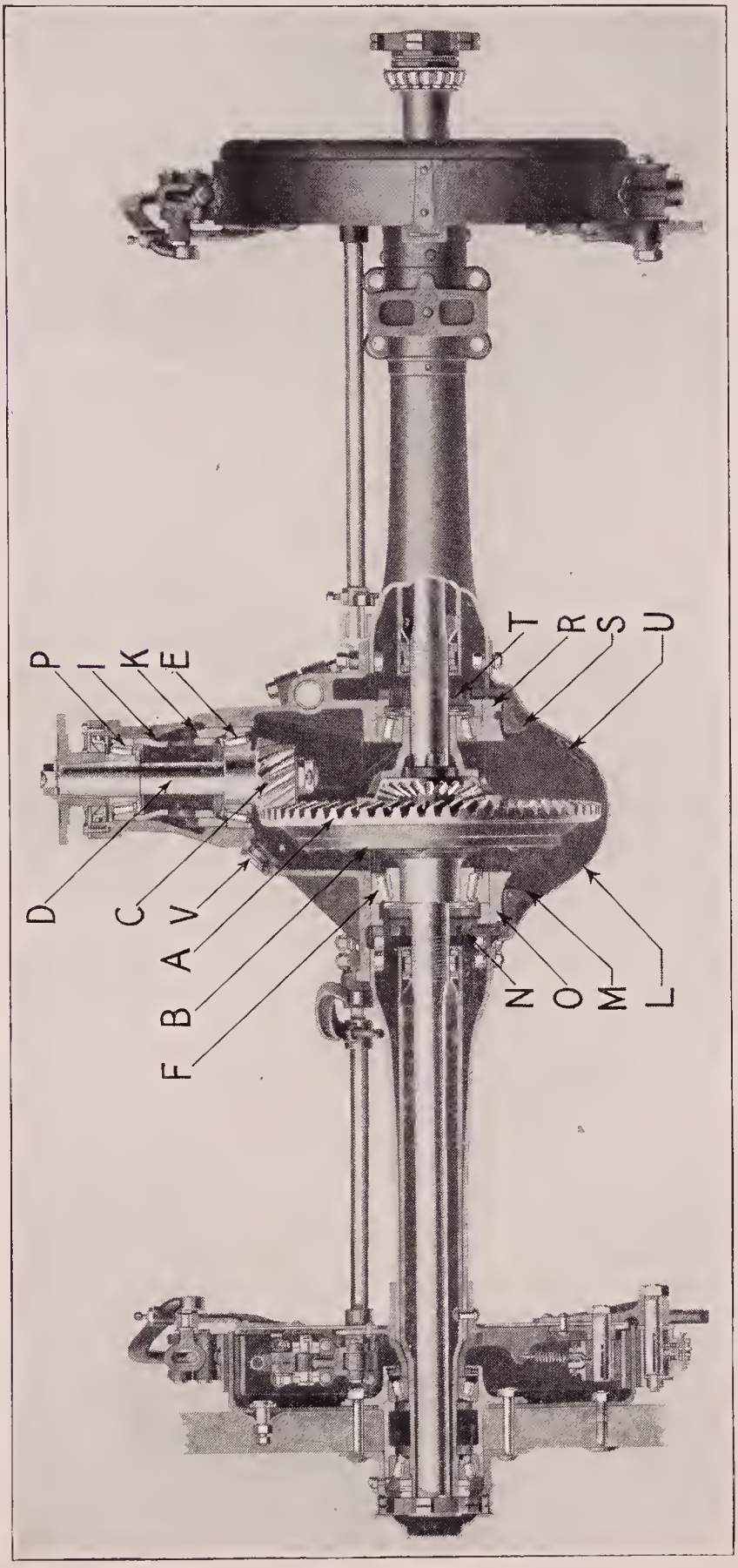


Fig. 15—Rear Axle. Sectional View.

bevel pinion "C" on the driving shaft "D," are correctly meshed when the car is assembled, but after it has been in use for several thousand miles it may be found that the bearings "E" and "F," which take the end thrust of the gears, have become more permanently seated, causing end play in the pinion shaft "D" and side play in the gear mount "B." When this condition exists, bearings "E" and "F" should be readjusted.

If undue end play exists in the pinion shaft "D," the bearing "E" should be adjusted as follows:

Loosen the two long clamping bolts on the pinion barrel and remove the cover plate giving access to the adjusting nuts "I" and "K." (See Note.) Hold the adjusting nut "I" from turning and turn up the adjusting nut "K" as far as possible without making the adjustment of bearing "E" too tight. (See under "Caution in Adjusting Timken Bearings," page 53.) After the adjustment has been made replace the cover plate over the opening and tighten the clamping bolts.

NOTE—The cover plate is at the top of the pinion barrel on some of the Type 57 axles. If the cover plate is at the top it is necessary to entirely remove the two long clamping bolts before the cover can be removed.

If, after removing the rear cover plate "L," undue side play is found in the gear mount "B," the bearing "F" should be adjusted as follows:

Move the key "M" entirely out of the slots in the adjusting nut "N," loosen the cap screws holding the cap "O" and turn the adjusting nut "N" as far as possible without making the adjustment of the bearings too tight. (See under "Caution in Adjusting Timken Bearings," page 53.) After the adjustment has been made, make sure that the key "M" is replaced in one of the slots in adjusting nut "N" and that the cap screws holding the cap "O" are tightened and locked.

Adjustment of Gears for Proper Meshing

If, after adjusting the bearings "E" and "F," Fig. 15, it is found necessary to move the pinion "C" endwise or the bevel gear "A" sidewise in order to bring the gears into proper mesh, it must first be determined whether it is necessary to move the pinion, the large bevel gear, or both, and in which direction the gear or gears must be moved.

Bevel gears should be so adjusted that the large ends of the teeth of one gear are practically flush with the large ends of the teeth of the other gear, which can be determined by removing the peep-hole cover "V." Extreme care must be used in adjusting, as the tooth forms of the most accurately cut gears may be easily ruined by running them when not properly meshed.

In order to adjust the gears to the best advantage a crank should be

attached to the forward end of the pinion shaft "D" so that the gears can be turned by hand and the adjustment tried until positions are found for the gears where they run smoothly and do not bind at any point.

If the bearings "E" and "P" on the drive shaft "D" are in proper adjustment, and if it is found necessary to move the pinion "C" endwise, proceed as follows:

Loosen the clamping bolts on the axle housing and the cover plate covering the adjustment hole. (See Note.) Move the adjusting nuts "I" and "K" *together*, moving the pinion in either direction as required. If the adjusting nuts "I" and "K" are moved in the same direction and exactly together, the relative adjustment of the bearings "P" and "E" will not be altered.

NOTE—The cover plate is at the top of the pinion barrel on some of the Type 57 axles. If the cover plate is at the top it is necessary to entirely remove the two long clamping bolts before the cover can be removed.

When the proper position for the pinion has been found, replace the cover plate over the opening and tighten the clamping bolts.

If it is found necessary to move the large bevel gear sidewise, proceed as follows:

First loosen the bolts holding caps "O" and "R." Then move the keys "M" and "S" out of the slots in the adjusting nuts "N" and "T." The adjusting nuts "N" and "T" can now be turned, moving the gear mount with the gear in either direction as required. Be careful not to adjust the bearings too tight. (See under "Caution in Adjusting Timken Bearings," page 53.)

After the correct position for the large driving gear has been found be sure that the keys "M" and "S" are replaced in the slots in the adjusting nuts "N" and "T" and that the bolts holding the caps "O" and "R" are tightened and locked.

Replace the cover "L," and fill with Cadillac Rear Axle and Transmission Lubricant, bringing the level up to the top of the filling hole "U."

BRAKES

FOOT BRAKES
(External Contracting)

Ordinary Adjustment

Provision is made in each brake for its adjustment. Do not attempt to adjust the brakes by the pull rods. The brakes cannot be properly adjusted in this manner. To adjust each foot brake, proceed as follows:

Remove the cotter pin in the adjusting screw "A," Fig. 16, and turn the screw "A" until that part of the brake band lining opposite the screw just clears the drum. Adjust the two nuts "B" on the yoke bolt so that the lower part of the brake band lining just clears the drum.

Then adjust the nut "C" on the upper end of the yoke bolt so that the lever "D" is brought into the position shown in Fig. 16, when the brake is fully applied—i. e., so that the lower edge of the pin "T" and the upper edge of the pin "S" are tangent to an imaginary horizontal line shown at "X."

Adjustment of Stop Screws

The position of the stop screw "E," Fig. 17, is adjusted when the car is assembled and requires no further attention unless its adjustment is altered. Adjustment for wear on the lining should be made as described above by the nuts "A," "B," and "C," Fig. 16; the stop screw "E" should not be adjusted to compensate for wear. If the stop screw "E" should be moved from its original position, it may be readjusted in the following manner:

First adjust the brake as explained above so that the lever "D," Fig. 16, is in the correct position when fully applied. Then release the brake. Remove the pin "A" in the yoke "B," Fig. 17, loosen the clamping screw "C" and push the stop "G" forward out of the way. Then adjust the stop screw "E" and the nuts "B," Fig. 16, so that the upper and lower parts of the brake band lining clear the drum by one thirty-second of an inch.

Then pull the rod "H," Fig. 17, as far forward as it will go without moving the rods "K" and "L." Holding the rod "H" in this position, push the stop "G" down against the bracket "F" and tighten the clamping screw "C." Then adjust the yoke "B" so that when the pin "A" is replaced the brake pedal arm "U" is held three-eighths of an inch away from the under side of the toe board.

After the adjustments are completed, be sure to lock all adjusting screws and nuts and to insert and spread all cotter pins.

HAND BRAKES
(Internal Expanding)

Ordinary Adjustment

Provision is made in each brake for its adjustment. Do not attempt to adjust the brakes by the pull rods. The brakes cannot be properly adjusted in this manner. To adjust each hand brake proceed as follows:

Place a jack under the rear axle housing and raise the axle so that the wheel can be turned by hand. Remove the cover "F," Fig. 16; this may be done by loosening the lock nut "G" and turning the bolt to the left about one-quarter of a turn, which releases the clamping bar "H."

Rotate the wheel until the opening gives access to the screw "J." Turn the screw "J" until that part of the brake band lining opposite the screw just clears the drum.

Rotate the wheel and through the opening loosen the seven locking screws "K." Then turn the two adjusting screws "L," which have right-hand threads on one end and left-hand threads on the other, so that when the brake is fully applied the center of the pin "M" stands three and three-sixteenths inches to three and one-quarter inches away from the inside of the brake drum at "Y." The screws "L" should be turned equally and in the same direction.

Release the brakes and adjust the stop screws "R" so that the upper and lower parts of the brake band lining are equidistant from

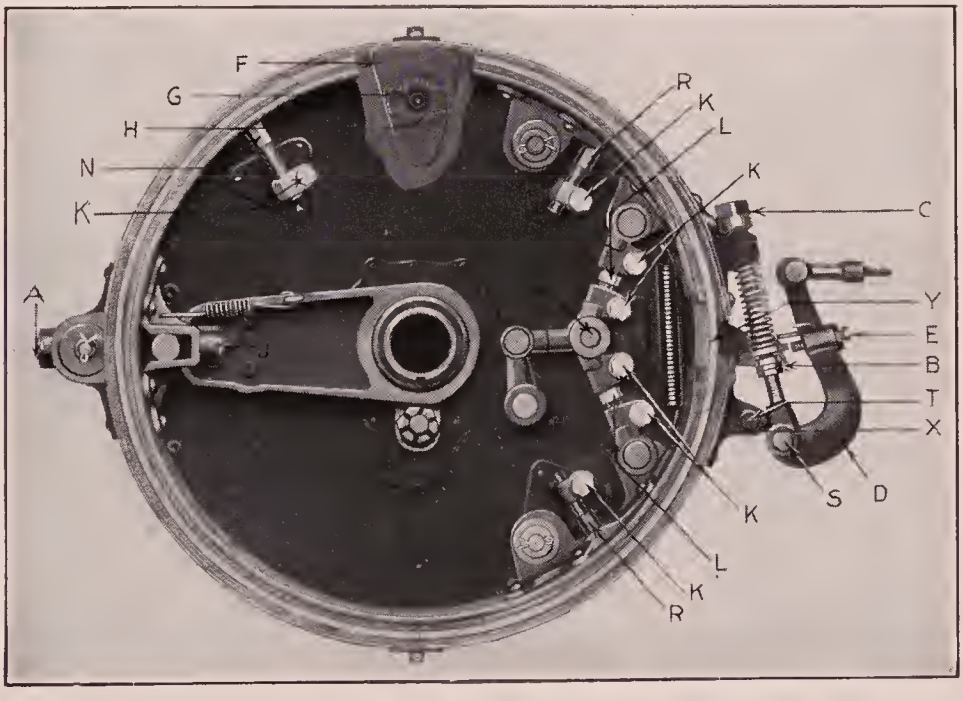


Fig. 16—Internal and External Brakes.

the brake drum. Adjust the stop screw "N" so that the head of the screw just touches the inside of the brake band. Tighten the seven locking screws "K" and replace the cover "F."

Adjustment of Stop Screws

The stop screw "O," Fig. 17, is adjusted when the car is assembled, and requires no further attention unless its adjustment is altered. Adjustment for wear on the linings should be made as described above by the screws "J," "L" and "R," Fig. 16; the stop screw "O" should not be adjusted to compensate for wear. If the original adjustment of the stop screw "O" has been altered, it may be readjusted in the following manner:

First, adjust the brake as described above by the screws "J" and "L," Fig. 16, but screw the stop screws "R" and "N" away from the brake band.

Then remove the pin "T" in the yoke "S," Fig. 17, and adjust the stop screw "O" so that when the brake is released the center of the pin "M," Fig. 16, stands three and nine-sixteenths inches away from the inside of the brake drum.

Adjust the stop screws "R" so that the upper and lower parts of the brake band are equidistant from the brake drum. Adjust the stop screw "N" so that the head of the screw just touches the inside of the brake band. Tighten the seven locking screws "K" and replace the cover "F."

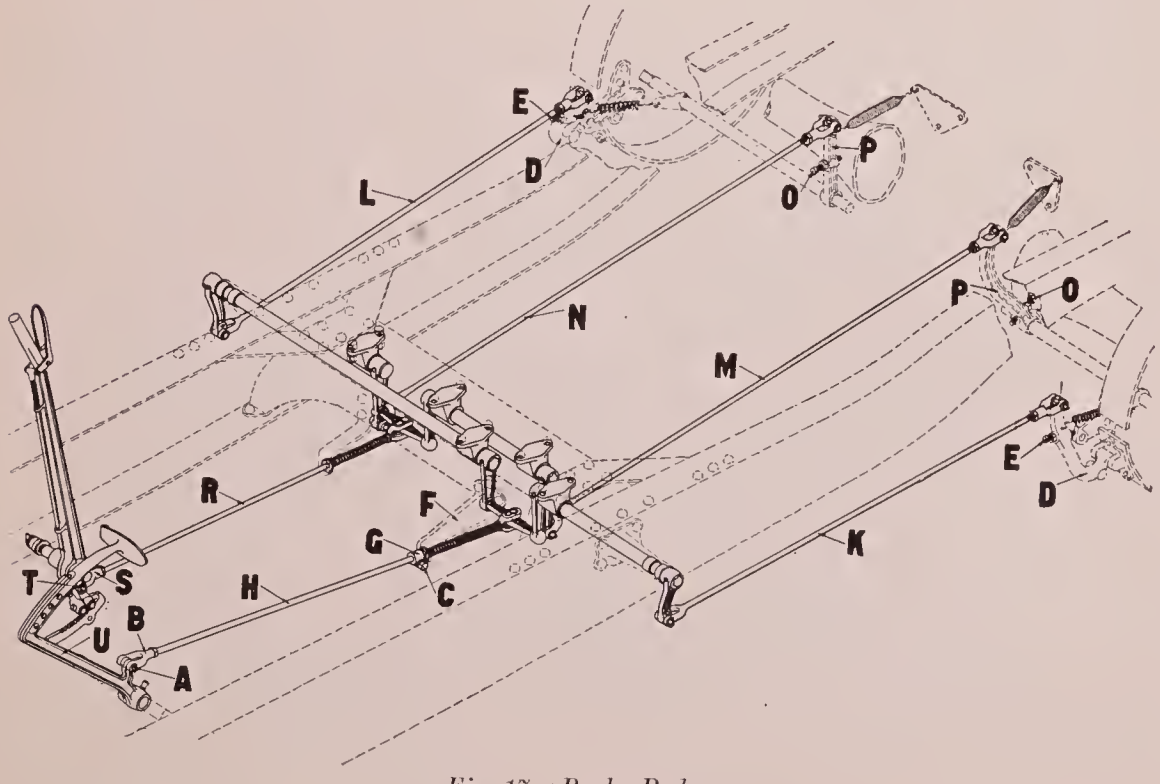


Fig. 17—Brake Rods.

Then adjust the yoke "S," Fig. 17, so that when the pin "T" is replaced the upper end of the handle on the hand brake lever may be moved back one and one-quarter inches from its extreme forward position without moving the rods "M" and "N."

After the adjustments are completed, be sure to lock all adjusting screws and nuts and to insert and spread all cotter pins.

Relining Brake Bands

To reline a brake band proceed as follows:

Remove the brake band. (See under "Brakes," page 125) and with a sharp cold chisel cut off the rivets which hold the lining, being careful not to spring the brake band.

Place the new lining on the band, being sure that it fits the brake band snugly and drill holes for the rivets.

Insert the rivets and head them over, being sure that the rivet heads are pulled well into the lining to prevent the rivet heads rubbing on the brake drums.

After replacing the brake band, adjust the brake in accordance with directions in this book under "Brake," page 46.

FRONT AXLE AND STEERING GEAR

FRONT AXLE

Spindle Arm Stop Screws

The stop screws "H," Fig. 47, are for the purpose of limiting the angle at which the front wheels can be turned. The stop screw at the left end of the axle limits the angle to which the wheels can be turned to the right. The stop screw at the right end of the axle limits the angle at which the wheels can be turned to the left.

The stop screws are adjustable and should be so set that the wheels are permitted to turn to as great an angle as possible, yet preventing the tires from rubbing on the right side spring, or the steering connecting rod on the left side.

Adjustment of Spindle Bearing

The bushing "G," Fig. 47, is pressed into the axle forging. If there is too much end play in the bearing "D" draw up on the adjusting nut "B," pulling the bushing "G" up against the under side of the spindle. Then back off the adjusting nut "B" just enough to free the adjustment. (See under "Caution in Adjusting Timken Bearings," page 53.)

STEERING GEAR

Adjustment of Worm Thrust Bearings

To take up the end play in the worm "K," Fig. 18, remove the plug "B," Fig. 19, and loosen the jamb nuts "J," and lock screws "A."

Then with a screw-driver or something else suitable, screw down the adjusting collar "L," Fig. 18, which can be seen through the hole from which the plug "B," Fig. 19, was removed, until the proper adjustment is made.

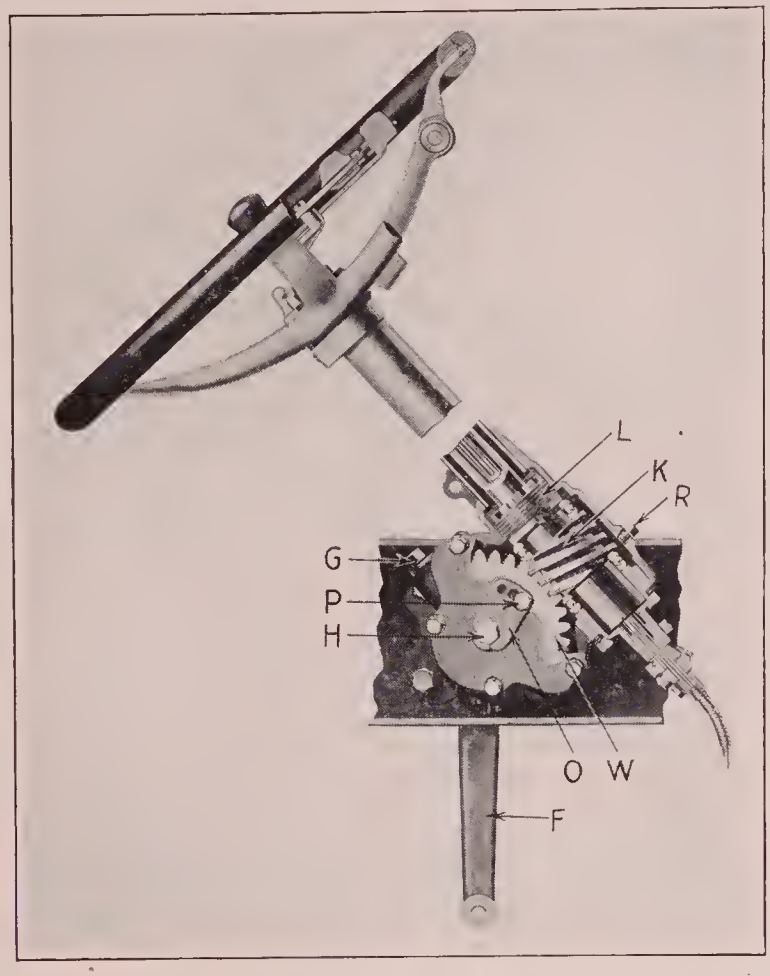


Fig. 18—Steering Gear, Sectional View.

Lock screws "A" are positioned in the steering gear housing so that when one is directly over a slot in the adjusting collar, the other is between two slots. Therefore, after adjusting the collar it will be necessary to select a proper screw for locking the adjustment. Both screws should be held from turning by locking the jamb nuts "J." Do not tighten against the adjusting collar, the screw which is not used for locking the adjustment.

Adjustment of Worm and Sector

An adjustment is provided for taking up wear on the teeth of the worm "K" and sector "W," Fig. 18. The sector "W" has its bearing in an eccentric steel bushing. Wear can be taken up by turning this bushing so that it throws the sector towards the worm.

To do this proceed as follows: First turn the steering wheel so that the front wheels point straight ahead. Remove the locking screw

"C," Fig. 19. As the bushing is assembled at the factory it is necessary to move the arm "D" down to tighten the adjustment.

If the wear on the teeth of the worm and sector is very great, it will be necessary to remove the steering arm "F" and to place the arm "D" in a different position on the hexagonal end of the eccentric bushing in order to bring the arm "D" in position so that it can be locked by the screw "C."

After the adjustment is made properly be sure that the lock screw "C" is replaced and properly tightened.

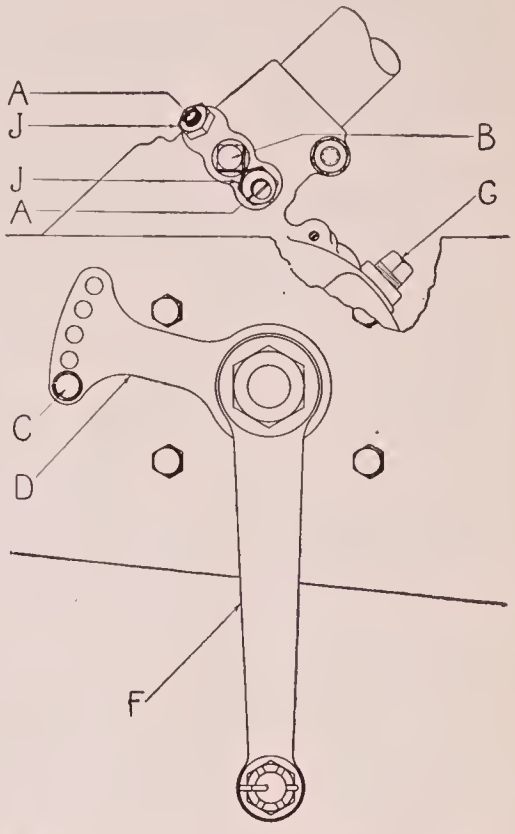


Fig. 19—Steering Gear Housing and Arm.

Adjustment of Sector Shaft

An adjustment is provided on the inner face of the steering gear housing for taking up end-play in the sector shaft.

To make this adjustment remove the locking arm "O," Fig. 18, and turn the adjusting screw in until the proper adjustment is made, after which the locking arm "O" should be replaced and the lock screw, "P," replaced and tightened.

CAUTION—Do not turn the steering gear when the car is standing. This is not only unnecessary but is also bad practice.

WHEELS

WHEEL BEARINGS

Adjusting Front Wheel Bearings

Remove the hub cap by unscrewing it; also remove the lock nut "A," Fig. 20, and the washer "B."

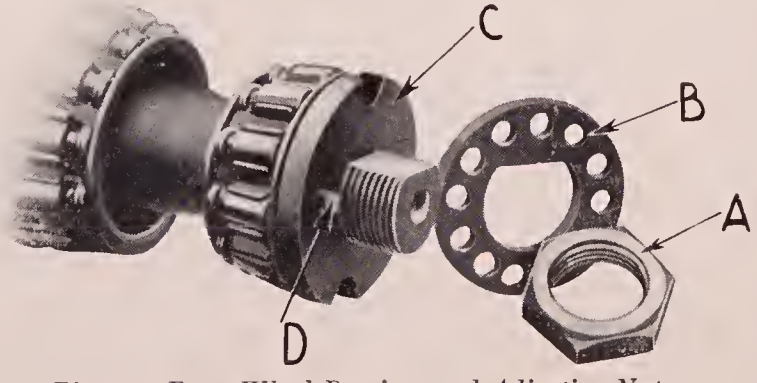


Fig. 20—Front Wheel Bearings and Adjusting Nuts.

Adjust the wheel bearings with the adjusting nut "C." (See under "Caution in Adjusting Timken Bearings.")

After completing the adjustment, replace the washer "B," making sure that it fits over the stud "D" properly. Screw on and tighten the lock nut "A."

The thread on the left-hand spindle is a left-hand one.

Adjusting Rear Wheel Bearings.

Remove the lubricator "A," Fig. 49, and unscrew the hub cap.

Remove the locking ring "K" and withdraw the axle shaft. If the axle shaft sticks it may be removed by tapping a cold chisel between the rear faces of the drivers on the axle flange and the bottoms of the recesses in the hub flange. If one of the axle shafts fits particularly tight, remove the looser one in accordance with directions given here and drive out the other by passing a bar of suitable size and length through the opposite end of the axle housing.

Loosen the lock nut "D" and make the adjustment with the adjusting nut "F," being careful to lock the adjustment with the nut "D" after completing it.

In adjusting the bearings be careful not to get the adjustment too tight. (See under "Caution in adjusting Timken bearings," page 53.)

ALIGNMENT OF FRONT WHEELS

The ideal condition is to have the front wheels parallel to each other on horizontal lines passing diametrically through their centers. Under no condition should the wheels toe out. It is permissible to have them toe in, providing they do not toe in more than three-eighths of an inch in the diameter of the wheel.

Jack up the front axle until both wheels are clear of the floor and true up the demountable rims on the wheels.

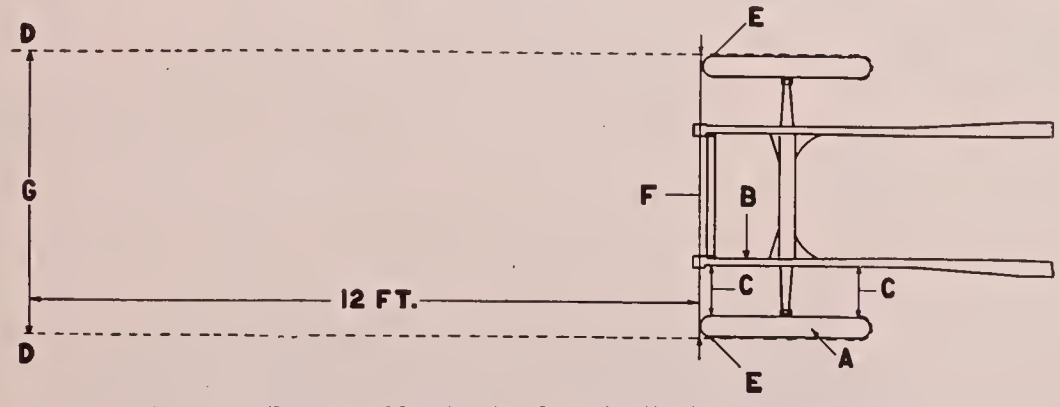


Fig. 21—Diagram Showing Method of Aligning Front Wheels.

Move the steering wheel to bring the left front wheel "A," Fig. 21, parallel with the frame "B." This may be determined by taking measurements "C" from the rim of the wheel to the frame.

Tie a string to a rear spoke of each front wheel directly back of the center of the wheel. Carry the strings inward between the spokes, back around the tires and then forward to points "D" as shown. Use strings that will extend exactly twelve feet in front of the tires. Bring the strings in until they *just touch* the forward edges of the tires at "E." The strings must be slightly above or below the hubs so as to clear them.

If the wheels are parallel, the distances "F" and "G" between the strings will be the same at points just ahead of the tires and at points at the ends of the strings.

Under no condition should the wheels toe in more than enough to allow the twelve-foot strings to converge more than one and one-half inches, that is, so that dimension "G" is not more than one and one-half inches less than dimension "F."

Adjustment is provided in the parallel rod for aligning the front wheels. If adjustment is necessary and the left front wheel is disturbed, care should be taken to have this wheel parallel with the frame before readjusting the strings and taking measurements "F" and "G."

The front wheels camber about one and one-half inches, that is, the measurement between the wheels at the top should be approximately one and one-half inches greater than the corresponding measurement diametrically opposite at the bottom of the wheels.

STRAIGHTENING BENT PARTS

Modern automobile construction demands the use of the highest grades of alloy steels. A great advantage of alloy steels is that by properly heating and cooling and re-heating such steels great strength and durability are obtained. However, heat treatment must be given with full and accurate knowledge of the contents of the steel, which cannot be obtained in the ordinary repair shop. Therefore, if any part is heated outside of this factory for the purpose of straightening or for other purposes, the part at once loses the advantage which the original heat treatment gave it.

CAUTION IN ADJUSTING TIMKEN BEARINGS

When adjusting Timken Bearings, great care must be exercised not to get them tight. These bearings will revolve even when adjusted very tightly, but that condition is sure to prove disastrous. They should be adjusted so that a very slight amount of play or looseness may be discerned.

If, after a bearing has been adjusted to a point that is apparently correct, the locking device cannot be placed in position without chang-

ing the adjustment, it is far better to *loosen* the adjustment until it can be secured with the locking device than to *tighten* the bearing adjustment.

WASHING CARS

The following directions should be followed carefully when washing a car.

Use clean water. Do not use water containing alkali. In parts of the country where the regular water supply contains alkali, rain water should be used.

Never use water colder than 40° Fahrenheit, or warmer than 60°.

If a hose is used never have greater pressure than will carry the water more than 6 inches beyond the end of the hose. Water under greater pressure will drive the grit and dirt into the finish.

A soft Rock Island natural sheep's wool sponge is best for washing the body and hood.

Begin washing at the top of the body panels and thoroughly wet the surface all over with water from the sponge. Continue until the accumulation of road dirt softens and gives way. Use clean water continuously and plenty of it. Go over the surface with plenty of water two or three times until it is perfectly clean.

Do not wash the hood while it is hot. The effect is the same as washing it with hot water.

Dry off with a clean soft chamois. Do not rub the finish or use pressure more than sufficient to dry off the water. The water will evaporate quickly and leave the finish in good condition.

Do not wash the windshield or the glass of enclosed cars with preparations which contain harmful ingredients. Use only cleaning compounds which are known to have no destructive effects on highly polished glass.

PART II

REMOVAL, INSPECTION AND REPLACEMENT

ENGINE

ROCKER ARMS AND SHAFTS

Removal

Remove the top cover plate. (See "Removal" under "Top Cover Plate," page 76.) Loosen the set screws holding the rocker arm shafts in place. Mark each rocker arm to be removed so it can be put back as originally assembled.

Remove the rocker arm shafts by lightly tapping them out.

Inspection

INSPECTION OF ROCKER ARMS AND SHAFTS—After cleaning the arms with gasoline or kerosene remove the pins which hold the rolls. This should be done with a press. Care must be exercised not to spring the arms.

The clearance between a rocker arm bushing and the shaft should not exceed .004 inch.

The clearance between a rocker arm roll and the pin upon which it rotates should not exceed .003 inch.

All bearing surfaces should be smooth.

The outer circumference of the rolls should be true within .0015 inch.

Rocker arm shafts should be a light press fit into the bronze bushings which receive them.

INSPECTION OF OTHER PARTS—Inspect the cams. They should be smooth and show practically no wear.

Replacement

Rocker arm pins should be well lubricated before the rolls are assembled. The rolls should rotate freely after assembly. In replacing reverse the operations under "Removal."

CRANK PIN BEARINGS

Removal

Remove the oil pan and the baffle plate. (See "Removal" under "Oil Pan and Baffle Plate," page 78.)

Open the compression cocks.

Remove the cotter pins and the two nuts from the cap of the straight connecting rod.

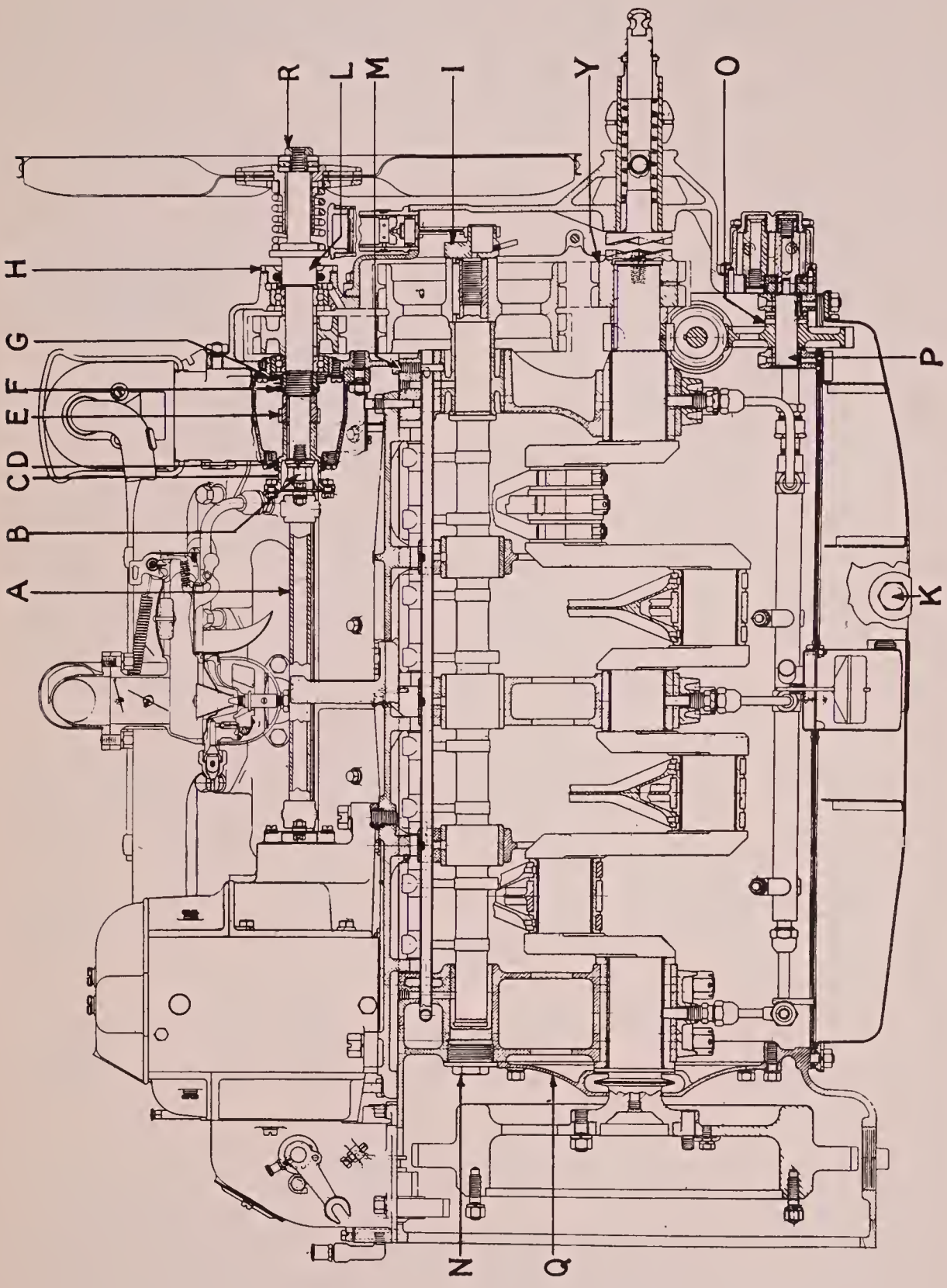


Fig. 22—Cross Section of Engine, Side View.

Remove the cap, being careful not to mix the liners.

Remove the rod and piston. Care must be exercised not to damage the piston in removing it. Do not allow the skirt of the piston to fall against the connecting rod.

Remove the cotter pins and the four nuts from the caps of the forked connecting rod and remove the caps.

Remove the rod with piston, being careful not to damage the piston, or to allow the halves of the crank pin bearing to drop.

Remove the halves of the bearing.

Inspection

INSPECTION OF BEARING—Clean the bearing with gasoline or kerosene and wipe it off with a cloth. In handling, be careful not to drop it or spring or mar it in any other way.

Inspect the bearing metal. If it is cracked, or cut so that it cannot be cleaned up with a scraper, without increasing the clearance between the bearing and crank pin to more than .006 inch, a new bearing should be substituted. (See under "Fitting Crank Pin Bearings," page 10.)

To insure against excessive oil consumption, smoking at the exhaust, the rapid formation of carbon in the cylinders, and noisy operation, the clearance between a crank pin bearing, when clamped in the rod, and the crank pin should not exceed .006 inch. End play in a crank pin bearing should not exceed .015 inch. There is no adjustment on crank pin bearings. Crank pin bearings .005 inch undersize are furnished by the Cadillac Motor Car Company.

Inspect the dowel pin holes in the bearing. The clearance between the pin holes and the pins should not exceed .002 inch.

Examine the oil hole in the bearing, cleaning it out if obstructed.

INSPECTION OF OTHER PARTS—Inspect the crank pin. The crank pin should be round within .003 inch and free from scores; if it is not, it should be dressed down. (See under "Dressing Down Crankshaft Bearing Surfaces," page 11). A new undersize bearing should be fitted if there is more than .006 inch clearance between the pin and bearing after the work is completed. (See under "Fitting Crank Pin Bearings," page 10.)

Examine the oil hole in the crank pin, cleaning it out if obstructed.

Inspect the pistons and piston rings in accordance with directions under "Piston and Piston Rings," page 74. If wear on a piston seems to indicate that the rod is sprung or twisted, test it for alignment. (See "Inspection of Rods" under "Connecting Rods," page 83).

Inspect the cylinder bores. Cylinder bores should be round within .002 inch and free from scores.

Replacement

With a cloth wipe off the halves of the bearing and well lubricate the bearing surfaces with engine oil of a suitable quality before replacing these parts.

In replacing reverse operations under "Removal."

Be sure to replace the connecting rods as originally assembled in engine. Connecting rods are numbered on the channel section (see "C," Figs. 28 and 29), indicating the cylinders in which they go. Number one forked rod and number one straight rod go into cylinders nearest the radiator; number two forked rod and number two straight rod into cylinders just back of these, etc. The numbers on the channel sections of the rods should face downward, and the numbered ends of the crank pin bearings should face to the rear.

Care should be exercised that the dowel pins in the forked rod are in the pin holes in the bearing, before tightening the cap nuts.

All nuts and bolts and both bearing caps of forked rods are numbered. One bolt and nut only and the cap of straight rods are numbered. Bolts, nuts and caps should be replaced in accordance with these numbers.

The following will serve to check the assembly of the connecting rods and crank pin bearings: The forked connecting rods should be on the left-hand side of the engine. The edges of the crank pin bearing halves where they come together should be in the horizontal plane when the pistons attached to the forked rods are on upper and lower centers. The longer piston pin bosses on the upper ends of the two center connecting rods in each cylinder block, should face toward each other. The longer piston pin bosses on the upper ends of the end connecting rods in each cylinder block should face from each other.

In adjusting the straight connecting rod follow directions under "Adjustment of Connecting Rod Bearings," page 9.

After replacing the oil pan refill it with one and one half gallons of suitable engine oil. Cadillac Motor oil is recommended.

MAIN BEARINGS

Removal

Remove the oil pan and the baffle plate. (See "Removal" under "Oil Pan and Baffle Plate," page 78.)

Remove the pipe between the main bearing cap and the oil feeder pipe.

Remove the cotter pins and nuts from the main bearing cap.

Remove the bearing cap with the lower half of the bearing. If more than one bearing is to be removed at a time, it is best to first remove the connecting rods to insure against springing them, should one end of the crankshaft drop lower than the other, (see "Removal"

under "Connecting Rods," page 82), also to support the crankshaft to prevent it dropping, which might injure it.

Care must be exercised not to mix the liners.

The upper half of the bearing can be removed by rotating it.

Inspection

INSPECTION OF BEARING—Clean the bearing with gasoline or kerosene and wipe it off with a cloth.

In handling the bearing be careful not to drop it or spring or mar it in any other way.

Carefully inspect the babbitt. If it is cracked, or cut so that it cannot be easily cleaned up with a scraper, replacement of the bearing should be made. (See under "Fitting Main Crankshaft Bearings," page 11).

The end thrust of the crankshaft is taken by the rear main bearing.

The shaft should have no more than .020 inch end play.

INSPECTION OF OTHER PARTS—Inspect the main bearing surfaces of the crankshaft. If any of them are out of round more than .003 inch, or scored, the shaft should be dressed down and the bearings refitted. (See under "Dressing Down Crankshaft Bearing Surfaces," page 11.)

Replacement

The bearings, liners and bearing cap should be carefully wiped off and the bearing surfaces lubricated with a good grade of engine oil before replacement is made.

In replacing, reverse operations under "Removal."

The bearings are numbered on one end. The one nearest the radiator is stamped "1," the center bearing "2," and the rear bearing "3." In replacing have the numbered ends toward the radiator.

In readjusting main bearings follow directions under "Adjustment of Main Crankshaft Bearings," page 9.

After replacing the oil pan refill it with one and one-half gallons of suitable engine oil. Cadillac Motor oil is recommended.

If after starting the engine it is found that the pressure gauge does not register pressure, stop the engine at once and prime the oil pump. This may be done by disconnecting at its upper end the oil pipe from the oil pressure regulator and forcing two to three gunfuls of clean engine oil into the pipe. Connect the pipe and tighten the union before starting the engine.

FANSHAFT AND BEARINGS

Removal

Remove the fan. (See "Removal" under "Fan," page 70.)

Remove the carburetor. (See "Removal" under "Carburetor," page 105.)

Remove the generator drive shaft "A." (Fig. 22.)

Remove the large cap screw "B."

Remove the coupling "C." A puller should be used for this.

Remove the distributor and timer. (See "Removal" under "Distribution and Timer," page 100.)

Remove the small spiral gear "E."

Remove the locking nut "F."

Remove the felt washer retainer "G" with washer.

Remove the large brass screw collar "H."

With a soft brass drift, no larger in diameter than the rear end of the fanshaft, carefully tap out the shaft, by tapping on the rear end of it.

Remove the rear fanshaft bearing.

Inspection

Clean all parts with gasoline or kerosene.

INSPECTION OF FANSHAFT AND BEARINGS—Inspect the oil hole "L," Fig. 22, and clean out if obstructed.

The end play in the annular ball bearings should be checked up. Holding the inner race, the outer race should have no more than .015 inch end play.

The bearings should be a hand press fit on the shaft. The races of the bearings should rotate smoothly and quietly.

INSPECTION OF OTHER PARTS—The bearings should be hand press fit in the housing.

There should be no more than .005 inch clearance between the fanshaft and the bushings in the fan hub.

Inspect the fan. (See "Inspection of Fan" under "Fan," page 70.)

Replacement

In replacing, reverse operations under "Removal."

All parts should be clean, and bearings well lubricated with a good grade of engine oil before replacement is made.

The inner races of the ball bearings are held from rotating on the fanshaft by the lock nut "F." It is important that this nut be well tightened in replacing.

It is necessary to retime the ignition after replacing the distributor housing (see under "Timing Ignition," page 23), also to put ten ounces of number two grease into the distributor housing. This may be done after removing the breather "Z," Fig. 34.

CYLINDER BLOCKS

Removal

Drain the Cooling System. (See under "Draining the Cooling System," page 34.)

Remove the connecting rods and pistons. (See "Removal" under "Connecting Rods," page 82.) It is possible to remove the cylinder block without first removing the connecting rods and pistons; to prevent damage to these parts, however, it is recommended that they be removed.

Remove the hose connections from the cylinder blocks.

Disconnect the high tension wires from the spark plugs, and remove the conduit brackets from the cylinder head. Remove the forward end of the conduit from the bracket on the aluminum cap by pulling the conduit out. Lay the conduit with wires back out of the way.

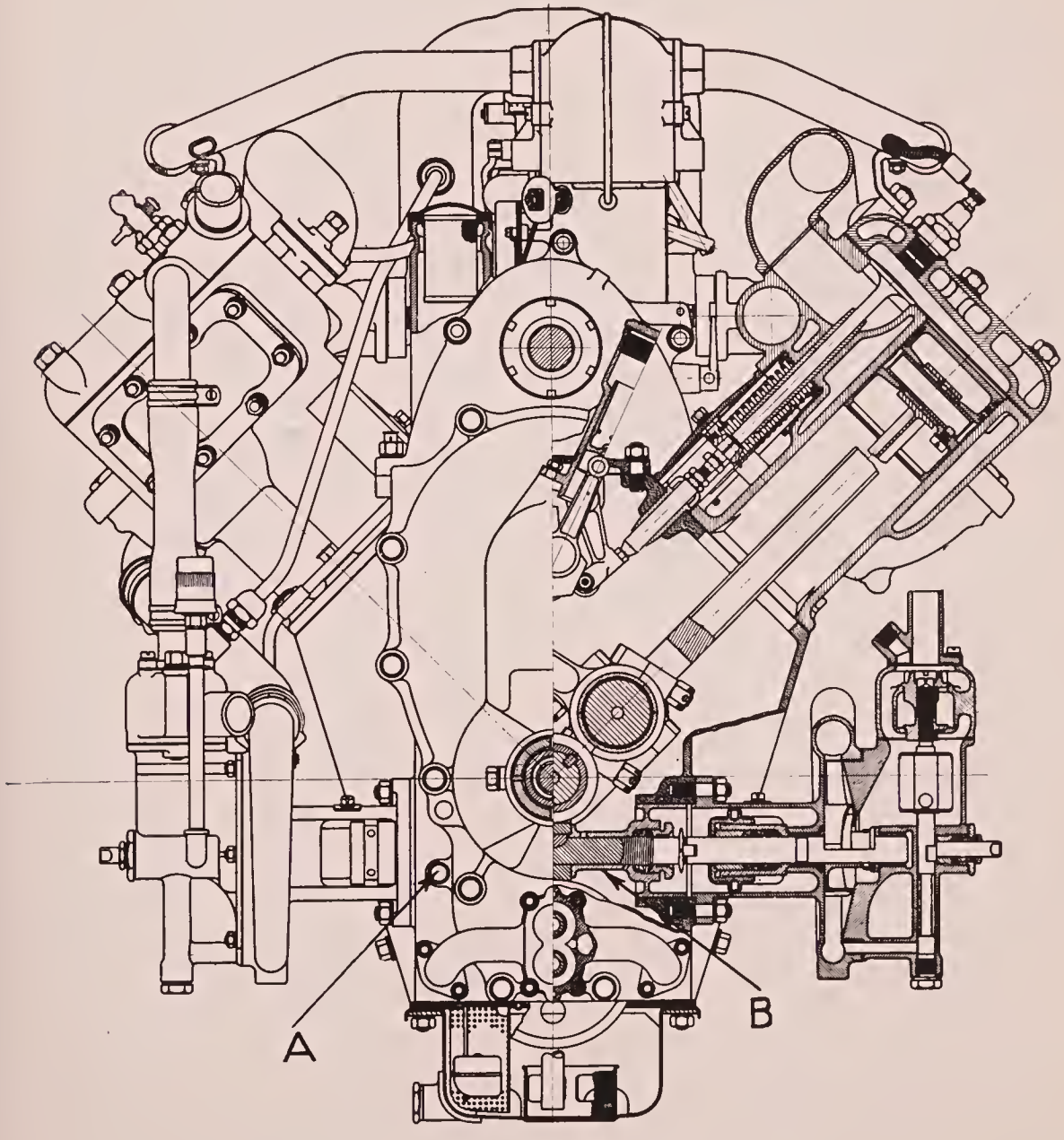


Fig. 23—Cross Section of Engine, Front View.

Disconnect the intake manifold from the cylinder block by removing the two cap screws.

Remove the small water pipe between the intake manifold and the cylinder block.

Disconnect the exhaust pipe from the exhaust manifold by removing the two bolts.

Remove the large threaded dowel pin at each end of the cylinder block by placing a spring washer over the pin large enough to permit the pin to be pulled through it, and screwing down and tightening one of the cylinder hold down nuts. The threaded end of each dowel pin is covered by a removable brass cap.

Remove the exhaust valves from the end cylinders. (See "Removal" under "Valves and Valve Springs," page 91.) This will facilitate the removal of the end hold down nuts on the inner row.

Remove the cylinder hold down nuts.

The cylinder block can now be removed.

Inspection

INSPECTION OF CYLINDER BLOCK AND VALVES—Remove the large cover plate at each end of the cylinder block and wash out the water jacket. Replace the end covers, making sure that the gaskets are in good condition, and clean the cylinder block with gasoline or kerosene.

Examine all cylinder bores. Cylinder bores should be free from scores and should be round within .002 inch.

There should be no more than .007 inch clearance between a cylinder bore and that part of the piston below the lower piston ring.

Inspect the valve seats, as well as the surfaces of the valves which contact with the seats. This may be done by forcing open the valves by hand. At the same time note if the valve stems work freely in their guides; if not, the valves should be removed and the stems and guides cleaned and lubricated.

If a valve or seat is pitted or if it appears that the valve has been leaking, the valve should be reground. (See under "Grinding Valves," page 14.)

INSPECTION OF OTHER PARTS—Inspect the pistons and piston rings. (See "Inspection of Piston and Rings" under "Piston and Piston Rings," page 74.) If the wear on a piston seems to indicate that the rod is sprung or twisted, test the rod for alignment. (See "Inspection of Rods" under "Connecting Rods," page 83.)

Inspect the crank pin bearings. (See "Inspection of Bearings" under "Crank Pin Bearings," page 57.)

Inspect the crank pins. Crank pins should be round within .003 inch and free from scores; if not they should be dressed down. (See under "Dressing Down Crankshaft Bearing Surfaces," page 11.)

A new undersize bearing should be fitted if there is more than .006 inch between a pin and bearing after the work is completed. (See under "Fitting Crank Pin Bearings," page 10.)

Replacement

Make sure that the cylinders and the pistons are free from carbon. Carbon can be removed with a soft iron scraper.

In replacing, reverse operations under "Removal."

Be careful to replace the connecting rods as originally assembled into the engine. Connecting rods are numbered on the channel section (see "C," Figs. 28 and 29), indicating the cylinders into which they go. Number one forked rod and number one straight rod go into cylinders nearest the radiator; number two forked rod and number two straight rod go into cylinders just back of these, etc. The numbers on the channel sections of the rods should face downward and the numbered ends of the rod bearings should face to the rear.

Care should be exercised that the dowel pins in the forked rods are in the pin holes in the bearings before tightening the cap nuts.

All nuts and bolts and both bearing caps of forked rods are numbered. One bolt and nut only and the cap of straight rods are numbered. Bolts, nuts and caps should be replaced in accordance with these numbers.

The following will serve to check the assembly of the connecting rods and crank pin bearings: The forked connecting rods should be on the left-hand side of the engine. The edges of the crank pin bearing halves where they come together should be in the horizontal plane when the pistons attached to the forked rods are on upper and lower centers. The longer piston pin bosses on the upper ends of the two center connecting rods in each cylinder block should face toward each other. The longer piston pin bosses on the upper ends of the end connecting rods in each cylinder block should face from each other.

In adjusting the straight connecting rod follow directions under "Adjustment of Connecting Rod Bearings," page 9.

After replacing the oil pan refill with one and one-half gallons of engine oil of a suitable quality. Cadillac Motor oil is recommended.

If a new cylinder block is installed it will be necessary to ream the dowel pin holes. With the block in place use a Number 8 standard taper reamer, being careful to catch all chips from the under side. Ream only enough to clean up the holes.

CRANKCASE

Removal

Remove and disassemble the engine. (See "Removal" and "Disassembly" under "Engine," pages 66 and 68.)

Inspection

With gasoline or kerosene clean all parts.

INSPECTION OF CRANKCASE—Examine the casting carefully and inspect all machined surfaces.

Examine the bushings for the camshaft. There should be no more than .005 inch clearance between the bushings and the shaft. The bushings should be free from scores. If it is necessary to replace one of the three center bushings tap it out carefully and carefully tap in the new bushing. If it is necessary to replace the rear bushing it will be necessary to first remove the cap "M," Fig. 22. The bushing may then be tapped out from the rear. Be sure in replacing a bushing that the oil hole is in line with the oil hole in the crankcase.

Make certain that all crankcase studs are tight in the aluminum and that they are screwed in as far as they should go.

INSPECTION OF OTHER PARTS—Inspect all parts in accordance with directions in this book.

Replacement

After inspecting all parts, reassemble and replace the engine. (See "Reassembly and Replacement" under "Engine," page 69.)

CAMSHAFT DRIVING CHAIN

Looseness of Chains

The looseness in the two engine chains may be determined by marking the rim of the fan, marking the radiator, and then oscillating the fan as far as possible without moving it on the fanshaft. If it is possible to oscillate the fan two inches or more at the rim, the chains should be inspected. (See below under "Inspection of Chain.")

Removal

Remove the front cover plate. (See "Removal" under "Front Cover Plate," page 75.)

Determine the amount of looseness in the chain to be removed. (See below under "Inspection of Chain.")

Cut off the riveted head of one of the seat pins and remove the seat and the rocker pins. (See Fig. 3.)

The chain can now be removed.

Inspection

INSPECTION OF CHAIN—With the chain in place on the sprockets and the front cover plate removed, determine the amount it is possible to move the camshaft sprocket without moving the crankshaft. If there is looseness enough in the chain to permit a movement of

three-sixteenths inch or more on the periphery of the camshaft sprocket it is recommended that a new chain be installed.

INSPECTION OF OTHER PARTS—Inspect the teeth of the crankshaft and camshaft sprockets. They should show very little wear.

Inspect the fanshaft driving chain. (See "Inspection of Chain" under "Fanshaft Driving Chain," page 66.)

Replacement

If the fanshaft chain has been removed replace it before replacing the camshaft chain. (See "Replacement" under "Fanshaft Driving Chain," page 66.)

In replacing the camshaft chain care must be exercised that the chain is so placed on the sprockets that the valve timing is correct.

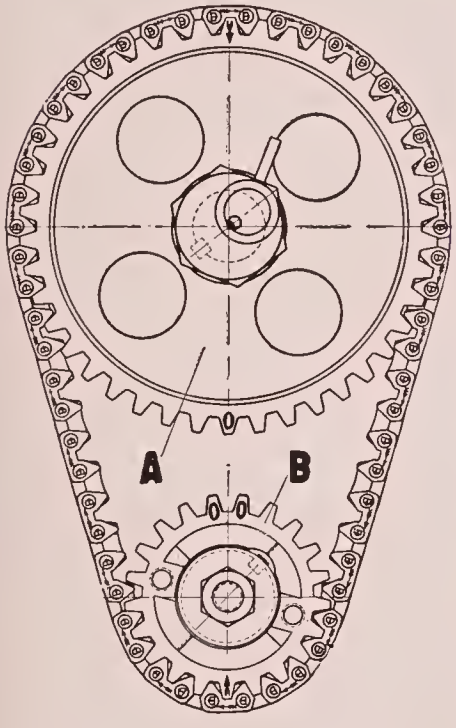


Fig. 24—Cam Shaft Driving Sprockets and Chain.

One tooth of the camshaft sprocket "A," Fig. 24, is marked with an arrow and the tooth diametrically opposite with an "O." One tooth on the crankshaft sprocket "B" has a similar arrow stamped on it and the two teeth opposite each are stamped with an "O" mark.

Turn the camshaft and crankshaft to bring the sprockets into the positions shown in Fig. 24. The arrows on the two sprockets must point toward each other and the tooth marked "O" of the camshaft sprocket must be directly opposite the space between the two similarly marked teeth on the crankshaft sprocket. Without turning either of the sprockets, replace the chain, with the arrows which are stamped on the outside links pointing in the direction in which the chain is to run. Bring the ends of the chain together, preferably on the camshaft sprocket, insert the pins and rivet. (See under "Riveting Chains," page 14.)

FANSHAFT DRIVING CHAIN

Looseness of Chains

The looseness in the two engine chains may be determined by marking the rim of the fan, marking radiator, and then oscillating the fan as far as possible without moving it on the fanshaft. If it is possible to oscillate the fan two inches or more at the rim the chains should be inspected. (See under "Inspection of Chain," page 64.)

Removal

Remove the camshaft driving chain. (See "Removal" under "Camshaft Driving Chain," page 64.)

Determine the amount of looseness in the chain to be removed. (See under "Inspection of Chain," page 64.)

Cut off the riveted head of one of the seat pins and remove the seat and rocker pins. (See Fig. 3.)

The chain can now be removed.

Inspection

INSPECTION OF CHAIN—With the chain in place on the sprockets and the front cover removed, determine the amount of looseness in it. This may be done in the following manner: Screw on and tighten the fanshaft nut "R," Fig. 22. Place a tight fitting nine-inch wrench on the nut. Determine the length of the arc through which it is possible to pass the end of the wrench without moving the camshaft sprocket. If the arc is one inch long or more it is recommended that a new chain be installed.

INSPECTION OF OTHER PARTS—Inspect the camshaft and fanshaft sprockets The teeth of these sprockets should show very little wear.

Inspect the camshaft chain and sprockets. (See "Inspection of Chain" under "Camshaft Driving Chain," page 64.)

Replacement

Place the chain on the fanshaft and camshaft sprockets, with the arrows which are stamped on outside links pointing in the direction in which the chain is to run. Bring the ends of the chain together on the camshaft sprocket. Insert the pins and rivet. (See under "Riveting Chains," page 14.)

In replacing the camshaft driving chain, see "Replacement" under "Camshaft Driving Chain," page 65.

After both chains are installed, retime the ignition in accordance with directions under "Timing Ignition," page 23.

ENGINE

Removal

Remove the hood.

Remove the rod connecting the arm on the steering gear to the arm on the cross shaft at the rear of the radiator.

Remove the two hood shelves.

Remove the radiator splash shield.

Remove the splash shield under the engine.

Remove the radiator. (See "Removal" under "Radiator," page 103.)

Disconnect one of the cables from the storage battery and place a block of wood under it to prevent it touching the terminal on the battery.

Remove the top cover plate from the generator.

Remove the large cable at the generator, also the five smaller wires.

Remove the floor boards.

Remove the pipe connecting the radiator and the radiator condensor.

Remove the transmission. (If the body is off, do not remove transmission from engine.) (See "Removal" under "Transmission," page 121.)

Remove, from the ignition coil, the high tension wire and the low tension wire which pass to the engine through the conduit.

Remove the conduit bracket from the dash and pull the two wires through the dash.

Remove the rod running through the dash to the carburetor.

Remove the two rods running from the steering gear to the engine.

Remove the speedometer cable.

Shut the gasoline valve at the tank and remove, from the body of the car, the pipe which leads from the strainer under the front floor, also remove the pipe which leads from the pressure relief valve under the front floor.

Remove the air pipe between the pressure relief valve and the power compressor at the front end of the engine, also the pipe between the settling chamber and the carburetor.

Disconnect the pipe from the oil pressure regulator.

Disconnect the steering gear bracket from the instrument board.

Remove the rear fenders. (See "Removal of Rear Fender" under "Fenders," page 148.)

Loosen the nuts on the two rear body bolts and remove the nuts from the remainder of the body bolts. Tap up the bolts from which the nuts are removed.

Jack up the front end of the body about eight inches and block it up so that it will not drop.

Disconnect the exhaust pipes from the exhaust manifolds.

Remove the cap screws which hold the cap of the front engine support.

Remove the cotter pins and nuts from the two large bolts which hold the rear engine supports to the frame.

Remove the two large bolts. To facilitate removal, jack up the rear of the engine just enough to relieve the bolts of the weight of the engine.

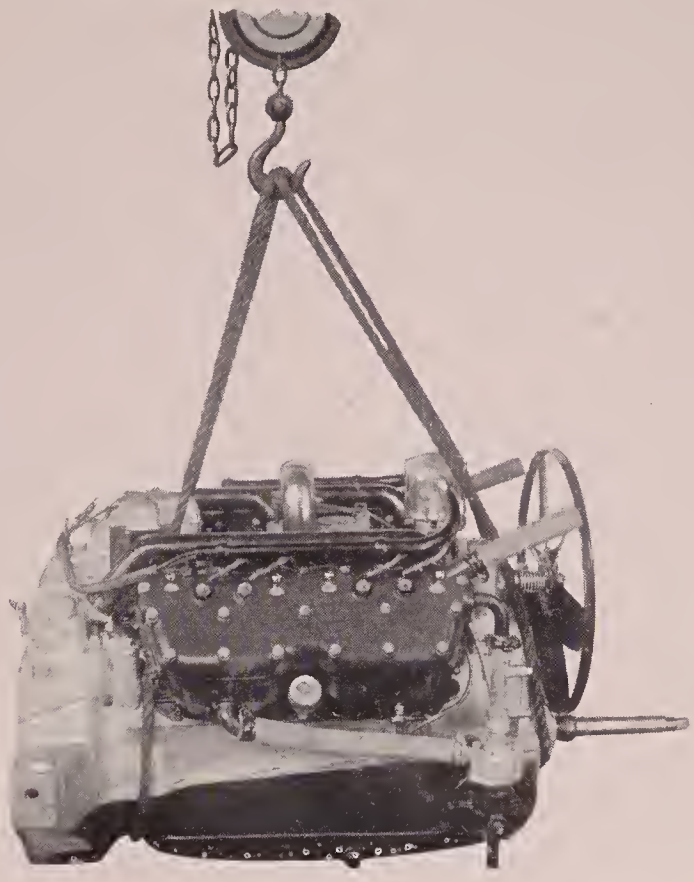


Fig. 25—Location of Rope in Lifting Engine from Frame.

With a suitable chain fall attached to a stout rope placed around the engine as shown in Fig. 25 lift out the engine carefully.

Disassembly

Remove the engine. (See "Removal.")

Wash off the engine and transmission with gasoline or kerosene.

Remove the transmission if not removed before removing engine. (See "Removal" under "Transmission," page 121.)

Remove the intake manifold with carburetor.

Remove the motor generator. (See "Removal of Motor Generator" under "Motor Generator," page 97.)

Remove the starter gear housing. The housing may be lifted off after removing the six cap screws and the two dowel pins and disconnecting the control rods.

Remove the water pumps. (See "Removal of Pump" under "Water Pumps," page 80.)

Remove the drive shaft for the water pumps. (See "Removal" under "Drive Shaft for Water Pumps," page 90.)

Remove the drain plug from the oil pan and drain out the oil.

Remove the oil pan and the baffle plate. (See "Removal" under "Oil Pan and Baffle Plate," page 78.)

Remove the spiral gear and the shaft which drives the oil pump. (See "Removal" under "Spiral Gear for Oil Pump Drive," page 70.)

Remove the fan. (See "Removal" under "Fan," page 70).

Remove the front cover plate. (See "Removal" under "Front Cover Plate," page 75.)

Remove the camshaft driving chain. (See "Removal" under "Camshaft Driving Chain," page 64.)

Remove the four cylinder head nuts which hold the brackets of the high tension conduits. Remove the distributor head and the low tension wire and remove the conduits with brackets, wires and head.

Remove the distributor rotor. This may be done by lifting it straight up. If the rotor sticks on the shaft force it off with two small screw drivers. The rotor is recessed on the under side at two points to receive screw drivers in removing. Lift both sides evenly and carefully.

Loosen the cap screw on the left rear corner of the fanshaft housing and remove the remaining three cap screws. Remove the two threaded dowel pins which position the fanshaft housing on the crankcase. These may be removed by placing over them spring washers large enough to permit the pins to be pulled through them and screwing on and tightening $\frac{5}{16}$ inch x 18 nuts.

Remove the nut "I" Fig. 22 (left-hand thread) and with a puller remove the camshaft sprocket, at the same time sliding forward the fanshaft housing with distributor housing attached.

Remove the connecting rods and pistons. (See "Removal" under "Connecting Rods," page 82.)

Remove the cylinder blocks. (See "Removal" under "Cylinder Blocks," page 60).

Remove the oil pressure regulator.

Remove the top cover plate. (See "Removal" under "Top Cover Plate," page 76.)

Remove the locking screw "M," Fig. 22.

Remove the camshaft and the forward camshaft bearing by pulling the shaft straight forward. If the bearing is tight in the crankcase it may be necessary to tap the shaft lightly.

Remove the flywheel. (See "Removal" under "Flywheel," page 92.)

Remove the crankshaft. (See "Removal" under "Crankshaft," page 87.)

Remove the oil manifolds from the crankcase.

Inspection

Inspect all parts in accordance with directions in this book.

Reassembly and Replacement

In reassembling and replacing the engine, reverse operations under "Disassembly" and under "Removal."

After tightening the nuts on the large bolts which hold the rear end of the engine to the frame, loosen them one notch and replace the cotter pins.

FAN

Removal

Remove the radiator. (See "Removal" under "Radiator," page 103.)

Remove the nut "R," Fig. 22. (Left-hand thread.)

The fan with hub can now be removed by pulling it straight forward.

Inspection

INSPECTION OF FAN—After cleaning the fan inspect the surfaces against which the friction discs press, also the rivets at the rim of the fan and at the center.

After the fan is put back and the engine is started, note if the fan runs true. If it does not it should be trued up.

INSPECTION OF OTHER PARTS—There should be no more than .005 inch clearance between the fanshaft and the bushings in the fan hub. The oil hole "L" in the fanshaft, Fig. 22, should be cleaned if necessary.

Replacement

Before replacing the fan, fill with cup grease the recesses in the friction members riveted to the fan and lubricate with engine oil the friction discs which press against these members. Also lubricate the thrust washers with cup grease.

In replacing the fan reverse the operations under "Removal."

SPIRAL GEAR FOR OIL PUMP DRIVE

Removal

Remove the oil pan and the baffle plate. (See "Removal" under "Oil Pan and Baffle Plate," page 78.)

Remove the front cover. (See "Removal" under "Front Cover," page 75.)

Determine the amount of clearance between the teeth of the gear to be removed and those of the gear with which it meshes. (See under "Inspection.")

Remove the taper pin "O," Fig. 22.

Remove the shaft "P." To do so tap it forward carefully.

Inspection

With kerosene or gasoline clean all parts.

There should be no more than .018 inch clearance between the teeth of the gear just removed and those of the gear with which it

meshes. The bearing surfaces of the drive shaft, and those of the bushings in which it rotates should be free from scores. There should be no more than .004 inch between the shaft and bushings. If necessary to replace either bushing drive it out carefully. Unless very great care is exercised in removing and replacing, there is a possibility of cracking the aluminum.

Examine the oil holes to each bushing. Clean out if obstructed.

Examine the faces of the thrust washer. They should be free from scores.

The gear should have no more than .008 inch end play.

The driving tongue at the forward end of the shaft should be no more than .004 inch narrower than the groove in the oil pump gear with which it meshes.

Replacement

In replacing, reverse operations under "Removal."

After replacing oil pan, refill with one and one half gallons of engine oil of a suitable quality. Cadillac Motor oil is recommended.

If, after starting the engine, it is found that the pressure gauge does not register pressure, stop the engine at once and prime the oil pump. This may be done by disconnecting, at its upper end, the oil pipe from the oil pressure regulator and forcing two to three gunfuls of clean engine oil into the pipe. Connect the pipe and tighten the union before starting the engine.

CYLINDER HEADS

Removal

Drain the cooling system. (See under "Draining the Cooling System," page 34.)

Remove the hose connections from the cylinder head.

Disconnect the high tension wires from the spark plugs and remove the conduit brackets from the cylinder head. Remove the forward end of the conduit from the aluminum cap by pulling the conduit out. Lay the conduit with wires back out of the way.

Remove the spark plugs. Remove the twenty nuts by which the cylinder head is held to the block.

Remove the cylinder head and the gasket.

Inspection

INSPECTION OF HEAD AND GASKET—Inspect the machined surfaces of the cylinder head. Inspect the gasket. Do not use the gasket again unless you are sure it is in condition for further use. Ordinarily a gasket may be used several times unless it is injured in removing.

INSPECTION OF OTHER PARTS—Inspect the cylinder bores. Cylinder bores should be free from scores.

Examine the machined face of the cylinder which presses against the gasket.

Replacement

With a soft iron scraper remove all carbon from the cylinder head, cylinder and piston heads.

After replacing the head, screw on the twenty hold-down nuts by hand. Then begin with the center nut in the middle row, work towards the ends, tightening the nuts lightly with a wrench. Then do the same with the nuts on the inner row, and finally with those on the outer row. After all nuts are tightened lightly, go over them again, tightening them firmly.

In refilling the cooling system follow directions under "Filling Cooling System," page 34.)

FANSHAFT HOUSING

Removal

Remove the fan. (See "Removal" under "Fan," page 70.)

Remove the distributor and timer. (See "Removal" under "Distributor and Timer," page 100.)

Remove the fanshaft. (See "Removal" under "Fanshaft and Bearings," page 59.)

Remove the two dowel pins which locate the fanshaft housing on the crankcase. To remove the dowel pins place spring washers over the pins large enough to permit the pins to be pulled through them, and screw on and tighten $\frac{5}{16}$ inch x 18 nuts.

Remove the four cap screws by which the fanshaft housing is held to the crankcase and the two cap screws by which the housing is held to the front cover plate.

The housing can now be removed.

Inspection

Clean all parts with gasoline or kerosene.

INSPECTION OF FANSHAFT HOUSING—Examine the machined surfaces of the housing. Also examine the casting.

The annular ball bearings should be a hand press fit in the housing.

INSPECTION OF OTHER PARTS—Inspect the fanshaft and fanshaft bearings. (See "Inspection of Fanshaft and Bearings," under "Fanshaft and Bearings," page 60.)

Replacement

In replacing, reverse operations under "Removal."

After replacing the distributor and timer, retime the ignition and place ten ounces of number two cup grease in the housing. The grease may be put in after removing the breather "Z," Fig. 34.

INTAKE MANIFOLD

Removal

Drain the cooling system. (See under "Draining the Cooling System," page 34.)

Unscrew the four unions connecting the small copper tubes to the front face of the manifold.

Remove the two cap screws holding the carburetor to the manifold.

Remove the two cap screws holding each intake manifold flange to a cylinder block.

The intake manifold can now be removed.

Inspection

INSPECTION OF INTAKE MANIFOLD—After cleaning the manifold inspect the finished surfaces against which the carburetor and cylinder blocks are bolted. The surfaces must be in good condition and perfectly flat to prevent air leaks at these points.

Inspect the water jacket of the manifold for leaks. This may be done by filling the manifold with water, then temporarily plugging three of the union nipples and applying water under approximately forty pounds pressure through the remaining nipple.

INSPECTION OF OTHER PARTS—Inspect the surface of the carburetor and the surface of the cylinder blocks which bolt against the manifold. These surfaces must be in good condition and perfectly flat.

Replacement

In replacing the intake manifold, reverse the operations under "Removal." Make sure that all gaskets are in good condition, also that the cap screws holding the manifold to the cylinder blocks and the carburetor to the manifold are well tightened to prevent air leaks.

PISTON PINS

Removal

Remove the piston and connecting rod. (See "Removal" under "Connecting Rods," page 82.)

The piston pin can be removed by pressing it out by hand after the small set screw in the piston pin support is removed.

Inspection

Thoroughly clean all parts with gasoline or kerosene and wipe them off with a cloth.

There should be no more than .003 inch clearance between the piston pin and the bushing and no more than .0015 inch clearance between the piston pin and the piston.

Replacement

To facilitate replacement of the screw which locks the piston pin, place the piston on the rod so that the piston pin support, with the screw, is on the side of the rod with the longer piston pin boss.

PISTON AND PISTON RINGS

Removal

Remove the connecting rods with pistons from the engine and the pistons from the connecting rods. (See "Removal" under "Connecting Rods," page 82.)

With hack saw blades as shown in Fig. 26, remove the piston rings. The teeth should be ground from the saw blades to prevent injury to the piston and rings. Care must be used in removing the rings not to strain them.

Fig. 26—Removing Piston Rings.

Inspection

Clean all parts with gasoline or kerosene.

INSPECTION OF PISTON AND RINGS—Pistons should be free from scores and round within .002 inch. The difference in width between the piston rings and the grooves should not exceed .003 inch.

Piston pins should have no more than .0015 inch clearance in the piston.

There should be no more than .007 inch clearance between the cylinder and the skirt of the piston and no more than .020 inch clearance between the ends of the rings when the piston is in place in the cylinder.

INSPECTION OF OTHER PARTS—If wear on a piston seems to indicate that the connecting rod is sprung or twisted, test the rod for alignment. (See "Inspection of Rods" under "Connecting Rods," page 83.)

Inspect the piston pin. (See "Inspection" under "Piston Pins," page 73.)

Inspect the piston pin bushings. (See "Inspection of Rods" under "Connecting Rods," page 83.)

Inspect the crank pin bearing. (See "Inspection of Bearing" under "Crank Pin Bearings," page 57.)

Inspect the crank pin. The crank pin should be round within .003 inch and free from scores; if it is not, it should be dressed down. (See under "Dressing Down Crankshaft Bearing Surfaces," page 11.)

A new standard or undersize bearing should be fitted if there is more than .006 inch clearance between the pin and the bearing after the work is completed. (See under "Fitting Crank Pin Bearings," page 10.)

Inspect the cylinder bores. Cylinder bores should be round within .002 inch and free from scores.

Replacement

With a scraper clean the carbon from the piston head, rings and ring grooves.

Clean all parts carefully and lubricate all bearing surfaces with engine oil of suitable quality.

Be careful to replace the connecting rod as originally assembled into the engine. Connecting rods are numbered on the channel section (see "C," Figs. 28 and 29), indicating the cylinders into which they go. Number one forked rod and number one straight rod go into cylinders nearest the radiator. Number two forked rod and number two straight rod in cylinders just back of these, etc. The numbers on the channel sections of the rods should face downward, and the numbered ends of the crank pin bearings should face to the rear.

All nuts and bolts and both caps of forked rods are numbered. One bolt and nut only and the cap of the straight connecting rod are numbered. Bolts, nuts and caps should be replaced in accordance with these numbers.

Care should be exercised that the dowel pins in the forked rods are in the pin holes in the bearing before tightening the cap nuts.

The following will serve to check the assembly of the connecting rods and crank pin bearings. The forked connecting rods should be on the left-hand side of the engine. The edges of the crank pin bearing halves where they come together should be in the horizontal plane when the pistons attached to the forked rods are on upper and lower centers. The longer piston pin bosses on the upper ends of the two center connecting rods in each cylinder block should face toward each other. The longer piston pin bosses on the upper ends of the end connecting rods in each cylinder block should face from each other.

In adjusting the straight connecting rod follow directions under "Adjustment of Connecting Rod Bearings," page 9.)

After replacing the oil pan refill it with one and one-half gallons of engine oil of a suitable quality. Cadillac Motor Oil is recommended.

FRONT COVER PLATE

Removal

Remove the radiator. (See "Removal" under "Radiator," page 103.)

Remove the hood shelves, also the splash pan at the front of the radiator.

Remove the splash pan under the engine.

Remove the fan. (See "Removal" under "Fan," page 70.)

Remove the air compressor cylinder and piston from the front cover plate. To remove the cylinder, first disconnect the air pipe, then remove the two small hold-down nuts. To remove the piston, crank the engine over by hand until the piston is at the top of its stroke, then move it forward.

Remove the cap of the front engine support.

Remove the two small nuts which hold each oil pump elbow flange to the crankcase.

Disconnect the exhaust pipes from the exhaust manifolds.

Jack up the front end of the engine about four inches.

Remove the two dowel pins which position the cover plate on the crankcase. These pins may be removed by placing over them spring washers large enough to permit the pins to be pulled through, then screwing on and tightening $\frac{3}{8}$ inch x 16 nuts.

Mark the twelve cap screws holding the cover plate in place and remove the screws.

Remove the cover plate.

Inspection

Clean the cover plate with kerosene or gasoline.

Carefully inspect all machined surfaces, also the gasket between the plate and crankcase.

Make sure that the starting shaft works freely in its bearings.

Replacement

In replacing, reverse operations under "Removal."

Be certain that the twelve cap screws which hold the cover plate to the crankcase are replaced as originally assembled.

TOP COVER PLATE

Removal

Remove the intake manifold with carburetor. (See "Removal" under "Intake Manifold," page 73, and under "Carburetor," page 105.) It is unnecessary, however, to remove the carburetor from the manifold, or to drop the drain pocket located under the carburetor.

Remove the motor generator. (See "Removal of Motor Generator" under "Motor Generator," page 97.)

Remove the distributor and timer. (See "Removal" under "Distributor and Timer," page 100.)

Remove the oil level dial. This may be done after the two small cap screws holding it to the cover plate are removed.

Drain the oil pan by removing the drain plug "K," Fig. 22. It is not absolutely necessary to drain the oil pan, but doing so allows the

float and float tube to drop, reducing the amount exposed above the cover plate. This is desirable as there is less likelihood of damaging the tube.

Remove the small red ball at the top end of the indicator tube. This may be done by tapping lightly upon the under side of the ball.

Remove the unions connecting the drain pipes to the drain pocket under the carburetor, and push the pipes to one side out of the way.

Remove the drain pocket.

Remove the nuts holding the cover plate to the crankcase, also the threaded dowel pin at each end of the cover plate. To remove a threaded dowel pin, place over it a spring washer large enough to permit the pin to be pulled through it, then screw on and tighten a $\frac{5}{16}$ inch x 18 nut.

Remove the cylinder heads. (See "Removal" under "Cylinder Heads," page 71.)

Raise all sixteen valves and hold them in the raised position. This may be done with tools number 69283 furnished by the Cadillac Motor Car Company. If these tools are not at hand remove all sixteen valves. (See "Removal" under "Valves and Valve Springs," page 91.)

Remove the clamps holding the cam slide bushings in place and raise the cam slides and bushings.

The top cover plate can be removed by lifting it straight up and at the same time cranking the engine over very slowly. Both ends of the cover plate must be lifted evenly.

Inspection

Clean all parts with gasoline or kerosene

INSPECTION OF TOP COVER PLATE—Inspect the cover plate.

Test with a straightedge the machined surfaces which bolt against the crankcase.

The bronze bushings in which the rocker arm shafts are held should be tight in the aluminum.

INSPECTION OF OTHER PARTS—Inspect the rocker arms and rocker arm shafts. (See "Inspection of Rocker Arms and Shafts" under "Rocker Arms and Shafts," page 55.)

Inspect the cams. They should show practically no wear.

Replacement

Make sure that the gasket between the plate and crankcase is in good condition.

In replacing, reverse the operations under "Removal."

After replacing distributor and timer, retime the ignition (see under "Timing Ignition," page 23) and put ten ounces of number

two cup grease into the distributor housing. This may be done after removing the breather "Z," Fig. 34.

Refill the oil pan with one and one-half gallons of suitable engine oil after replacing it. Cadillac Motor Oil is recommended.

OIL PAN AND BAFFLE PLATE

Removal

Remove the splash pan under the engine.

Drain the oil pan. This is done by removing the plug "K," Fig. 22.

Remove the twenty-seven nuts holding the oil pan to the crankcase, and remove the oil pan, being careful not to injure the cork gasket between the oil pan and the baffle plate.

Remove the oil float with the tube to which it is soldered. The small red ball at the upper end of the float tube will prevent the tube dropping down. The ball may be removed, however, by pushing the float up an inch or so and pulling it down, repeating the operation until the ball is forced off.

Remove the two nuts which hold the baffle plate to the oil suction pipe which extends down into the oil pan.

Remove the baffle plate, being careful not to injure the cork gasket between the baffle plate and crankcase.

Inspection

Inspection of Oil Pan and Baffle Plate—With gasoline or kerosene clean the oil pan and baffle plate. Make a careful inspection of these parts, also of the cork gaskets. The oil pan should be free from dents. The surface which presses against the gasket must be in good condition.

The screen of the baffle plate must be free from injury.

Inspection of Other Parts—Make sure that the unions are tight on all of the oil pipes inside of the crankcase. To determine this try them with a wrench.

Determine if the float contains oil. If it does it may be repaired by soldering it after the oil has been drained out.

If the float tube is bent in removing, straighten it before replacing.

Replacement

In replacing, reverse operations under "Removal."

To replace the red ball on the upper end of the indicator tube, it is necessary to remove the oil indicator, which can be done by removing the two screws. The red ball is a taper fit on the oil tube and should be tapped in place lightly.

After replacing the oil pan, refill it with one and one-half gallons of suitable engine oil. Cadillac Motor Oil is recommended.

If after starting the engine it is found that the oil pressure gauge does not register pressure, stop the engine at once and prime the oil pump. This may be done by disconnecting, at its upper end, the oil pipe from the oil pressure regulator and forcing two to three gunfuls of clean engine oil into the pipe. Connect the pipe and tighten the union before starting the engine.

OIL PUMP

Removal

Remove the splash pan under the engine.

With gasoline or kerosene wash the pump and the front end of the engine around the pump.

Remove the two small nuts on each pump flange and the four small nuts by which the body of the pump is held to the front cover plate.

Remove the pump by pulling it straight forward. The pump will come off easily if both ends are removed evenly.

Inspection

Clean all parts with kerosene or gasoline, and inspect the pump body and elbows.

There should be no more than .004 inch clearance between the teeth of the pump gears and the pump body, no more than .004 inch clearance between the bearings at each end of the pump gears and the bushings in which they operate, and no more than .006 inch end play in the pump gears. There should be no more than .004 inch clearance between the tongue on the drive shaft for the oil pump and the slot in the lower pump gear.

Replacement

In replacing, reverse operations under "Removal," first making sure that all gaskets are in good condition, also that the surfaces which press against these gaskets are clean.

If Cadillac made gaskets are not procurable make gaskets of paper .009 inch to .011 inch in thickness. If the gaskets are too thick, too much end play in the pump gears will be permitted resulting in a less efficient pump. All three gaskets must be made of paper of equal thickness.

If after starting the engine it is found that the pressure gauge does not register pressure, stop the engine at once and prime the oil pump. This may be done by disconnecting, at its upper end, the oil pipe from the oil pressure regulator and forcing two to three gunfuls of clean engine oil into the pipe. Connect the pipe and tighten the union before starting the engine.

WATER PUMPS

Removal of Pump

Drain the cooling system. (See under "Draining the Cooling System," page 34.)

Remove the splash pan under the engine.

Disconnect at the water pump all hose connections, also the copper pipe to the intake manifold.

Remove the two nuts which hold the pump to the crankcase.

The pump can now be removed. Remove both sides evenly.

Removal of Thermostat

Remove the pump. (See under "Removal of Pump," on this page.)

Remove the thermostat housing cap "R," Fig. 27.

Remove the large brass nut "F" and the shaft "L."

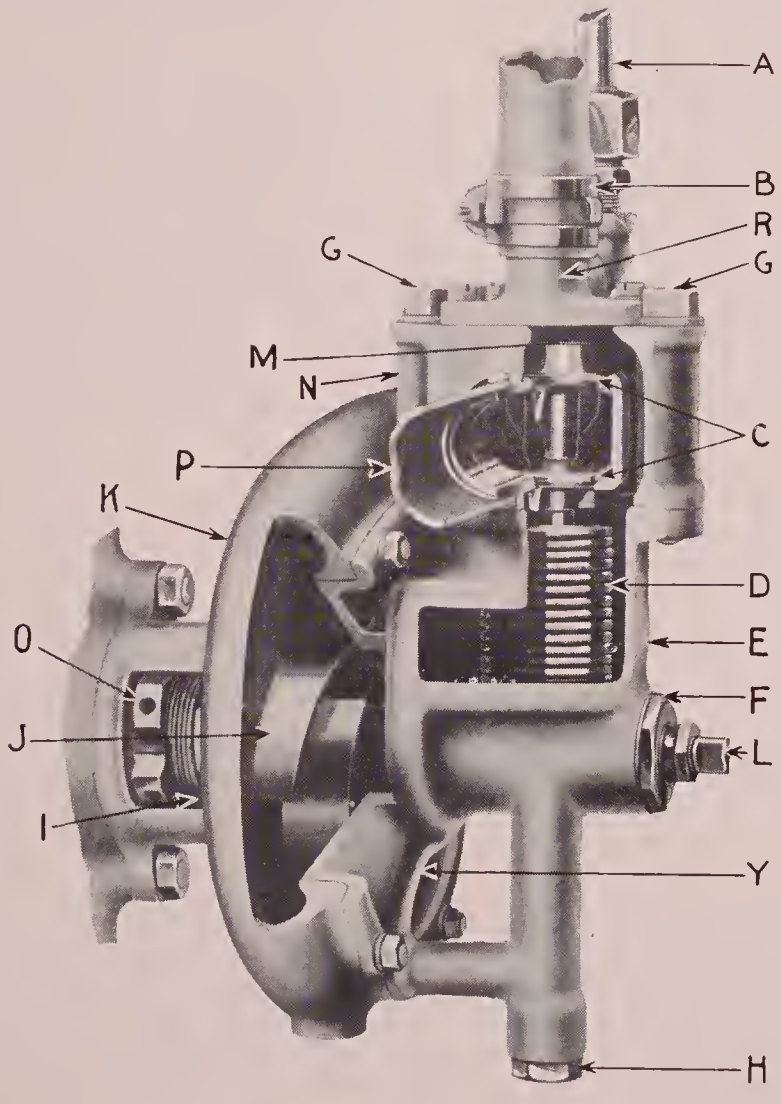


Fig. 27—Water Pump, Sectional View.

Remove the cap screws "G" on the thermostat housing "N," and remove the thermostat housing with valves and thermostat. Be careful not to injure the thermostat in removing.

Loosen the lock nut "M."

Remove the thermostat from the valves by unscrewing the thermostat.

Removal of Thermostat Valve

Drain the cooling system. (See under "Draining the Cooling System," page 34.)

Disconnect at the water pump, hose connections "P" and "B," Fig. 27, also copper pipe "A."

Remove the thermostat housing cap "R."

Loosen the lock nut "M."

The valve may now be removed by unscrewing.

Removal of Pump Impeller

Remove the pump. (See under "Removal of Pump," page 80.)

Remove the pump cover "Y." Fig. 27.

The impeller with shaft may then be removed. The pump shaft is held to the pump impeller by a taper pin. The shaft may be forced out of the impeller with a press after the pin is removed.

Inspection

Test the thermostat by immersing it in water at a temperature of between forty degrees and sixty degrees Fahrenheit, then immersing it in water heated to a temperature of one hundred and eighty degrees. If the thermostat is in good condition it should expand three-sixteenths inch. Make sure that the thermostat is clean between the coils and in good condition otherwise.

Inspect the valves "C," Fig. 27, and the valve seats. Remove any rust or scale which has accummulated and regrind the valves if necessary.

The pump impeller and the bushings in which it operates, should be free from scores. The clearance between the shaft and either bushing should not exceed .006 inch. If it is necessary to remove the bushing which has the packing gland on its outer end, drive it out with a soft brass drift, after first driving out the $\frac{5}{16}$ inch x $\frac{3}{16}$ inch brass pin "I." The bushing in the pump cover may be removed by pulling it out. This bushing is not pined.

The pump impeller should have no more than .010 inch clearance in the pump body with the pump cover in place.

Examine the packing in the gland "O." If it is necessary to repack the gland follow directions under "Water Pump Packing Glands," page 35.

Replacement

In replacing, reverse operations under "Removal."

If the adjustment between the valves "C," Fig. 27, and the thermostat "D" has been altered, readjust in accordance with directions under "Adjustment of Thermostat Valves," page 35.

OIL PRESSURE REGULATOR

Removal

Remove the oil pipe from the regulator by unscrewing the union.

Remove the four one-fourth inch nuts and washers holding the regulator to the crank case and remove the regulator.

Unscrew the cap from the regulator and remove the spring and ball.

Inspection

With kerosene or gasoline clean all parts.

Examine the ball. It should be clean and free from pits.

Examine the ball seat. The seat should be free from pits. It can be removed from the housing by driving it out carefully.

Examine the one-sixteenth inch by-pass hole in the housing. (See Fig. 53.) The by-pass has an outlet in the hole through which oil passes to the pressure gauge pipe. The by-pass should be cleaned if obstructed.

The valve spring should have a free length of two and seven-eighths inches and should support a load of between six and one-half and seven and one-half pounds when compressed to one and three-fourths inches.

The surfaces of the housing which bolt against the crankcase should be in good condition.

Replacement

In replacing, reverse operations under "Removal."

If the regulator is in proper adjustment after installation the pressure gauge on the instrument board will indicate a pressure of between five and seven pounds when the engine is warm, idling at approximately 300 revolutions per minute, and the oil in the engine is of a suitable quality and fresh. Cadillac Motor Oil is recommended. If a higher or lower oil pressure is indicated, readjustment should be made in accordance with direction under "Adjustment of Oil Pressure Regulation," page 154.)

CONNECTING RODS

Removal

Remove the oil pan and the baffle plate. (See "Removal" under "Oil Pan and Baffle Plate," page 78.)

Open the compression cocks.

Remove the cotter pins and the two nuts from the cap of the straight connecting rod. Remove the cap, being careful not to mix the liners.

Remove the rod and piston. Care must be exercised not to damage the piston in removing it. Do not allow the skirt of the piston to fall against the connecting rod.

Remove the cotter pins and the two nuts from each cap of the forked connecting rod and remove the caps.

Remove the rod and piston, being careful not to damage the piston or to allow the halves of the connecting rod bearing to drop.

Remove the bearing halves.

Remove the pistons from the connecting rods. This can be done by first removing the small set screw in the piston pin boss and pushing out the pin by hand.

Inspection

With kerosene or gasoline clean all parts removed.

INSPECTION OF RODS—The piston pin bushing should be free from scores. There should be no more than .003 inch clearance between the pin and the bushing. If it is necessary to replace the bushing proceed as follows: With a press force out the used bushing and force in the new one, being sure that the oil holes line up. Be careful not to spring the rod. Then ream the new bushing, using a three-fourths inch reamer. The size of the bushing when reamed should be between .7495 inch and .7502 inch. The rod should be tested for alignment after the bushing is in place and reamed.

The bearing at the lower end of the forked connecting rod must clamp in the rod. To cause this the diameter of that portion of the bearing which is held in the rod must be .001 inch greater than the rod diameter, taken lengthwise of the rod. If the bearing is not clamped, the caps on the rod may be reduced by rubbing them carefully over fine emery cloth stretched tightly over a machined surface plate.

The bearings in the upper and lower ends of the rods should be parallel and in the same plane.

To test the forked connecting rod for alignment, proceed as follows:

Clamp the bearing into the lower end of the rod, being sure that it is clamped properly. The numbered end of the bearing should be to your right when the rod is held large end down and with the number on the channel section (see Fig. 28) toward you. Lightly force a tight fitting mandrel into the bearings at each end. The mandrel should be at least 6 inches long. Lay two parallel bars on a face plate and the connecting rod with the mandrels on the parallel bars as shown in Fig. 28. The mandrels should lay on the parallel bars squarely at all four points. To determine if the bearings are parallel take measurements "A" and "B." The mandrels should be parallel within .001 inch

in their length of 6 inches. A dial indicator can be used in making this test.

To test the straight rod for alignment, bolt the cap in place, then lightly force a tight fitting mandrel into the upper and lower bearings and proceed as in testing the forked rod. (See Fig. 29.)

If the bearings are not in the same plane, or are not parallel, the rod may be trued up by holding it in a vise, being careful to protect it with blocks of wood, and with a wrench springing it.

INSPECTION OF OTHER PARTS—Inspect the crank pin bearing. (See "Inspection of Bearing" under "Crank Pin Bearings," page 57.)

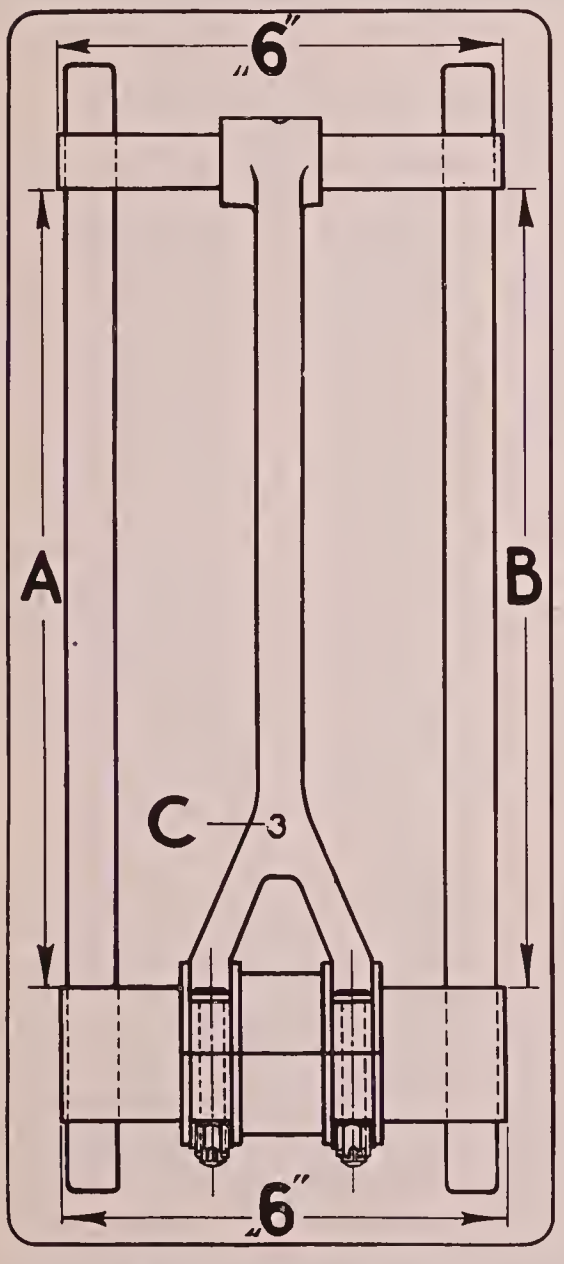


Fig. 28—Method Employed in Testing Alignment of Forked Connecting Rods.

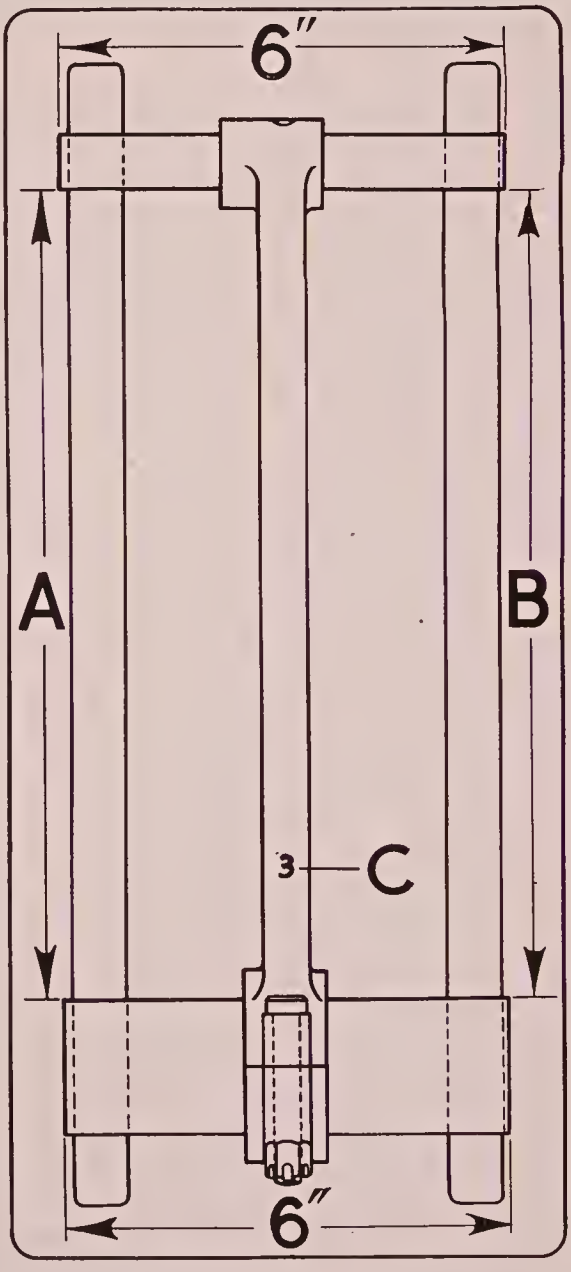


Fig. 29—Method Employed in Testing Alignment of Straight Connecting Rods.

Inspect the crank pin. The crank pin should be round within .003 inch and free from scores; if it is not it should be dressed down. (See under "Dressing Down Crankshaft Bearing Surfaces," page 11.) A new undersize bearing should be fitted if there is more than .006 inch clearance between the used bearing and pin, after the work is completed. (See under "Fitting Crank Pin Bearings," page 10.)

Inspect the pistons and the piston rings in accordance with directions under "Piston and Piston Rings," page 74.

Inspect the piston pins. (See "Inspection" under "Piston Pins," page 73.)

Inspect the cylinder bores. They should be round within .002 inch and free from scores.

Replacement

With a cloth carefully wipe off the pistons, connecting rods, and bearings and lubricate the bearing surfaces with engine oil of a suitable quality.

To facilitate replacement of the screws which lock the piston pins, pistons should be so placed on the rods that the supports which have the screws are on the sides of the rods which have the longer piston pin bushing bosses.

In replacing, reverse the operations given under "Removal."

Connecting rods are numbered on the channel section (see "C," Figs. 28 and 29), indicating the cylinders into which they go. Number one forked rod and number one straight rod go into cylinders nearest the radiator; number two forked rod and number two straight rod into cylinders just back of these, etc. The numbers on the channel sections of the rods should face downward, and the numbered ends of the bearings at the lower ends of the rods should face to the rear.

Care should be exercised that the dowel pins in the forked rod are in the pin holes in the bearing before the cap nuts are tightened.

All nuts and bolts and both bearing caps on the forked rods are numbered. One bolt and nut and the cap only of the straight rod are numbered. Bolts, nuts and caps should be replaced in accordance with these numbers.

The following will serve to check the assembly of the connecting rods and crank pin bearings: The forked connecting rods should be on the left-hand side of the engine. The edges of the crank pin bearing halves where they come together should be in the horizontal plane when the pistons attached to the forked rods are on upper and lower centers. The longer piston pin bosses on the upper ends of the two center connecting rods in each cylinder block should face toward each other. The longer piston pin bosses on the upper ends of the end connecting rods in each cylinder block should face from each other.

In adjusting the straight connecting rod follow directions under "Adjustment of Connecting Rod Bearings," page 9.

After replacing the oil pan, refill it with one and one-half gallons of suitable engine oil. Cadillac Motor Oil is recommended.

CAMSHAFT

Removal

Remove the camshaft driving chain. (See "Removal" under "Camshaft Driving Chain," page 64.)

Remove the eccentric nut "I," Fig. 22 (left-hand thread).

Remove the carburetor. (See "Removal" under "Carburetor," page 105.)

Remove the generator drive shaft "A," Fig. 22.

Disconnect the timer control rod.

Remove the two cylinder head nuts which hold the brackets on the left-hand high tension conduit. Loosen the small screws of the brackets which hold the right-hand conduit. Remove the distributor head and the low tension wire and lift the left-hand conduit with wires and head over to the right side.

Remove the distributor rotor. This may be done by lifting it straight up. If the rotor sticks on the shaft, force it off with two small screw drivers. The rotor is recessed on the under side at two points to receive screw drivers in removing. Lift both sides of the rotor evenly and lift it carefully.

Loosen the cap screw on the left rear corner of the fan shaft housing and remove the remaining three cap screws.

Remove the two threaded dowel pins. This may be done by placing a spring washer over them large enough to permit the pins to be pulled through them and screwing on and tightening $\frac{5}{16}$ inch x 18 nuts.

With a puller remove the camshaft sprocket, at the same time sliding forward the fanshaft housing with the distributor and timer attached.

Remove the top cover plate. (See "Removal" under "Top Cover Plate," page 76.)

Remove the set screw "M."

Remove the camshaft and the forward camshaft bearing by pulling the shaft straight forward. If the bearing is tight in the crankcase it may be necessary to tap the shaft lightly.

Inspection

Inspection of Camshaft—Clean the shaft with gasoline or kerosene and wipe it off with a cloth.

Inspect the oil hole at the forward end of the shaft, cleaning it out if necessary.

Inspect the cams carefully. They should show practically no wear.

All bearing surfaces of the camshaft should be round within .003 inch and free from scores. The clearance between the camshaft and the bearings should not exceed .005 inch.

INSPECTION OF OTHER PARTS—Inspect the camshaft bearings in the crankcase. The bearing surfaces should be free from scores. If it is necessary to replace one of the three center bearings tap it out and carefully tap in the new bearing. If it is necessary to replace the rear bearing, first remove the flywheel (see "Removal" under "Flywheel," page 92), then remove the cap "N." The bearing may then be driven out from the rear. Be sure that the oil hole in the bearing lines up with the oil hole in the crankcase.

Inspect the rocker arms and rocker arm shaft. (See "Inspection of Rocker Arms and Shafts" under "Rocker Arms and Shafts," page 55.)

Replacement

In replacing, reverse operations under "Removal."

Be sure to replace the camshaft driving chain correctly. (See "Replacement" under "Camshaft Driving Chain," page 65.)

CRANKSHAFT

Removal

Remove the top cover plate. (See "Removal" under "Top Cover Plate," page 76.)

Remove the camshaft driving chain. (See "Removal" under "Camshaft Driving Chain," page 64.)

Remove the flywheel. (See "Removal" under "Flywheel," page 92.)

Remove the cover "Q," Fig. 22, at the rear end of the crankcase.

Remove the connecting rods and pistons. (See "Removal" under "Connecting Rods," page 82.)

Determine the amount of clearance between the teeth of the spiral gear on the crankshaft and those of the gear with which it meshes. (See under "Inspection.")

Remove the main bearings, being careful that the shaft does not drop. (See "Removal" under "Main Bearings," page 58.)

Carefully tap up the main bearing bolts until their lower ends are flush with the machined surfaces against which the liners are held.

The crankshaft can now be removed.

Inspection

INSPECTION OF CRANKSHAFT—Remove the seventeen small plug screws by unscrewing them with a large screw driver and clean out

the oil ways thoroughly. Replace the plugs and tighten, locking them by making a fairly light punch mark between the shaft and each screw.

Wash the shaft with gasoline or kerosene and inspect all bearing surfaces. If any of the bearing surfaces are cut, or out of round more than .003 inch they should be dressed down. (See under "Dressing Down Crankshaft Bearing Surfaces," page 11.) If after dressing down a crank pin there is more than .006 inch clearance between the pin and the crank pin bearing, a new standard or undersize bearing should be fitted. (See under "Fitting Crank Pin Bearings," page 10.)

End play in a crank pin bearing should not exceed .015 inch. The clearance between a crank pin bearing and the crank pin should not exceed .006 inch. There is no adjustment on crank pin bearings. Crank pin bearings .005 inch undersize are furnished by the Cadillac Motor Car Company.

The end thrust of the crankshaft is taken by the rear main bearing. The crankshaft should have no more than .020 inch end play in this bearing.

Place the shaft on lathe centers. It should run out of true no more than .004 inch at the center bearing.

INSPECTION OF OTHER PARTS—Examine the oil hole in the spiral gear on the crankshaft. Clean out if obstructed.

Inspect the main and crank pin bearings. (See "Inspection of Bearing" under "Main Bearings" and under "Crank Pin Bearings," pages 57 and 59.)

Inspect the pistons and piston rings. (See "Inspection of Piston and Rings" under "Piston and Piston Rings," page 74.) If the wear on a piston seems to indicate that the rod is sprung or twisted, test the rod for alignment. (See "Inspection of Rods" under "Connecting Rods," page 83.)

Inspect the cylinder bores. They should be round within .002 inch and free from scores.

When the crankshaft is in place there should be no more than .018 inch clearance between the teeth of spiral gear on the shaft and those of the gear with which it meshes.

Inspect the camshaft and fanshaft driving chains and sprockets. (See "Inspection of Chain" under "Camshaft Driving Chain," page 64, and under "Fanshaft Driving Chain," page 66.)

Inspect the flywheel. (See "Inspection" under "Flywheel," page 93).

Inspect the annular ball bearing at the rear end of the crankshaft. The races should rotate smoothly and quietly and have no more than .015 inch end play.

Replacement

Before replacing the shaft, wipe it off with a cloth and lubricate the bearing surfaces with engine oil of a suitable quality.

In replacing, reverse the operations under "Removal."

The main bearings are numbered on one end. The bearing nearest to the radiator is stamped "1," the center bearing "2" and the rear bearing "3." In replacing, have the numbered ends toward the radiator. In adjusting the main bearings follow directions under "Adjustment of Main Crankshaft Bearings," page 9.)

Be careful to replace the connecting rod as originally assembled into the engine. Connecting rods are numbered on the channel section (see "C," Figs. 28 and 29), indicating the cylinders into which they go. Number one forked rod and number one straight rod go into cylinders nearest radiator; number two forked rod and number two straight rod go into cylinders just back of these, etc. When placed in the engine the numbers on the channel sections of the rods should face downward, and the numbered ends of the bearings at the lower ends of the rods should face to the rear.

All nuts and bolts and both bearing caps of forked rods are numbered. One bolt and nut only, and the cap of straight rods are numbered. Bolts, nuts and caps should be replaced in accordance with these numbers. Care should be exercised that the dowel pins in the forked rods are in the pin holes in the bearings before the cap nuts are tightened.

The following will serve to check the assembly of the connecting rods and crank pin bearings. The forked connecting rods should be on the left-hand side of the engine. The edges of the crank pin bearing halves where they come together should be in the horizontal plane when the pistons attached to the forked rods are on upper and lower centers. The longer piston pin bosses on the upper ends of the two center connecting rods in each cylinder block should face toward each other. The longer piston pin bosses on the upper ends of the end connecting rods in each cylinder block should face from each other.

In adjusting the straight connecting rods follow directions under "Adjustment of Connecting Rod Bearings," page 9.

After replacing the oil pan refill it with one and one-half gallons of suitable engine oil. Cadillac Motor Oil is recommended.

If after starting the engine it is found that the pressure gauge does not register pressure, stop the engine at once and prime the oil pump. This may be done by disconnecting, at its upper end, the oil pipe from the oil pressure regulator and forcing two to three gunfuls of clean

engine oil into the pipe. Connect the pipe and tighten the union before starting the engine.

DRIVE SHAFT FOR WATER PUMPS

Removal

Remove the splash pan under the engine.

Drain the cooling system. (See under "Draining the Cooling System," page 34.)

Remove the oil pan and the baffle plate. (See "Removal" under "Oil Pan and Baffle Plate," page 78.)

Determine the amount of clearance between the teeth of the gear on the drive shaft for the water pumps and those of the gears with which it meshes. (See under "Inspection.")

Remove one of the water pumps. (See "Removal of Pump" under "Water Pumps," page 80.)

Remove the set screw "A," Fig. 23, holding the drive shaft bushing nearest the pump just removed and remove the bushing.

Remove the drive shaft with gear and thrust bearing.

The remaining drive shaft bushing can be removed if desired, after removing the remaining water pump and the set screw "A" which holds the bushing.

Inspection

Clean all parts with kerosene or gasoline.

INSPECTION OF DRIVE SHAFT, GEAR, BUSHINGS AND THRUST BEARING—The drive shaft and the bushings in which it rotates should be free from scores. There should be no more than .006 inch clearance between the shaft and bushings.

Inspect the balls of the thrust bearing, also the thrust washer and the side of the gear upon which the balls rotate. The balls should be free from pits and in good condition. The surfaces of the washer and gear should be free from pits and worn no more than .006 inch where the balls contact with them. If these parts are worn or pitted they may be reversed and used again.

There should be no more than .018 inch clearance between the teeth of the gear and those of the gears with which it meshes. If it is necessary to remove the gear from the shaft do so with a press. Be sure in pressing on the gear that it stands exactly in the center of the shaft.

INSPECTION OF OTHER PARTS—Examine the packing in the glands of the water pumps before replacing the pumps. (See under "Water Pump Packing Glands," page 35.)

Replacement

In replacing, reverse operations under "Removal."

The grooved end of the shaft should be on the left side.

Be sure that the bushings are so placed that the pilots on the locking screws enter the holes in the bushings.

With the bushings locked in place the drive shaft should have no less than .002 inch end play and no more than .005 inch.

New drive shaft bushings are not drilled for locking screws. In installing new bushings make sure that their outer edges are equally distant from the faces of the crankcase, that the drive shaft has from .002 inch to .003 inch end play and that the inner oil holes of the bushings face up. Then locate positions for the holes for the set screws, remove the bushings and drill these holes. Very great care must be exercised in positioning these holes.

CAM SLIDES AND GUIDES

Removal

Remove the valve, over the cam slide and guide to be removed. (See "Removal" under "Valves and Valve Springs," on this page.) The cam slide may then be lifted out.

Remove the clamp which holds the guide for the cam slide and remove the guide.

Inspection

INSPECTION OF CAM SLIDE AND GUIDE—There should be no more than .004 inch clearance between a cam slide and the guide in which it operates.

The upper face of the head of the cam slide adjusting screw should show very little wear.

INSPECTION OF OTHER PARTS—Inspect the valves in accordance with directions in this book. (See "Inspection" under "Valves and Valve Springs," page 92.)

Replacement

In replacing, reverse operations under "Removal."

Time the valves in accordance with directions in this book under "Adjustment of Cam Slide," page 13.)

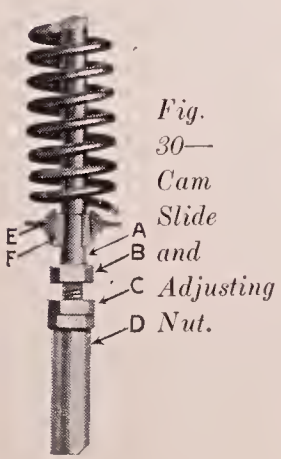


Fig. 30—Cam Slide and Adjusting Nut.

VALVES AND VALVE SPRINGS

Removal

Remove the cylinder head. (See "Removal" under "Cylinder Heads," page 71.)

Remove the carburetor. (See "Removal" under "Carburetor," page 105.)

Remove the valve cover plate.

Force up washer "E," Fig. 30, then remove the split collar "F." Let the washer "E" down carefully and both sides evenly.

(If all valves in a block are to be removed at one time, and tool number 69283 furnished by the Cadillac Motor Car Company is at hand, all eight washers "E" may be lifted at one time and the washers and springs held in position while the collars and valves are removed and replaced.)

Inspection

Clean all parts with gasoline or kerosene.

INSPECTION OF VALVES—Clean the valve seat in the cylinder block, and the bushing in which the valve stem operates. Any carbon on the valve stem, or in the bushing should be removed.

There should be no more than .004 inch clearance between a valve stem and the valve stem bushing.

Inspect the valve seat in the cylinder block and the surface of the valve which bears on the seat. If the valve or valve seat is pitted or if it appears that the valve has been leaking it should be reground. (See under "Grinding Valves," page 14.)

Inspect the valve spring. Valve springs should have a minimum free length of four and three-fourths inches and a minimum pressure of eighty-five pounds when compressed to three inches.

Replacement

In replacing, reverse the operations under "Removal."

The timing of the valves should be checked up after replacement is made. (See under "Adjustment of Cam Slide," page 13.)

FLYWHEEL

Removal

Remove the transmission. (See "Removal" under "Transmission," page 121.)

Remove the two five-sixteenths inch cap screws and clips holding the dowel pins in place.

Remove the dowel pins. This may be done by placing spring washers over them large enough to permit the pins to be pulled through them and screwing on and tightening two of the nuts which hold the flywheel.

Remove the six seven-sixteenths inch nuts which hold the flywheel to the crankshaft, and remove the felt washer retainer, steel washer, felt washer and paper gasket.

The flywheel can now be removed.

Inspection

INSPECTION OF FLYWHEEL—Make an inspection of the teeth on the flywheel. If the teeth are burred somewhat on the ends, smooth them up with a mill file.

INSPECTION OF OTHER PARTS—With kerosene or gasoline wash out the annular ball bearing at the rear end of the crankshaft. Inspect this bearing by rotating the inner race and by noting the amount of end play in the race. The race should rotate smoothly and quietly and should have no more than .015 inch end play. The bearing is a close fit in the crankshaft and may be removed either with a suitable puller, or by suitably bent pries.

Replacement

Before replacing the felt washer soak it in lubricating oil of a good quality, and fill the space between the races of the bearing with number two cup grease.

Have the forward cylinder in the left-hand block on firing center before replacing the flywheel. Then replace the flywheel, having the number one and five marks, stamped on the wheel, directly under the pointer attached to the crankcase.

ELECTRICAL SYSTEM

CIRCUIT BREAKERS

Inspection

The right-hand circuit breaker, protecting the circuits to the horn, handy lamp and tonneau-lamp, should remain closed under a load of 25 amperes, but should open and remain open under a load of 30 amperes, or more. The left-hand breaker protecting circuits to the ignition apparatus, and the remainder of the lamps should remain closed under a twenty-five ampere load, but should vibrate under a load of thirty amperes or more.

The right-hand circuit breaker may be tested by connecting a rheostat to wires attached to a double connector inserted in the handy lamp socket. The left-hand circuit breaker may be tested by removing one of the head light wires, connecting one wire from a rheostat to the wire and the other wire from the rheostat to the frame of the car. By turning on current to the headlamps and watching the ammeter on the dash the amount of resistance may be determined. The dash ammeter registers 30 amperes only, which is sufficient for testing either circuit breaker. Increasing the load to more than 30 amperes may injure the ammeter.

If either circuit breaker operates under a load of less than 25 amperes, or refuses to operate under a load of 30 amperes, it is recom-

mended that the breakers be replaced and returned to the factory for adjustment.

Removal

Disconnect at the storage battery one of the large cables and block it up to prevent it touching the terminal of the storage battery.

Mark the four wires on the circuit breakers so that they may be replaced as originally assembled. Loosen the nuts on the four terminals and remove the wires.

Remove the two small bolts which hold the circuit breakers to the dash.

Replacement

In replacing the circuit breakers make sure that the four wires are replaced as originally assembled, that the terminals on the wires and on the circuit breakers are clean and that all connections are well tightened.

MOTOR GENERATOR

Testing the Motor Generator. (On Car.)

Test the generator field windings and the generator armature windings for short circuit, open circuit or ground by turning on ignition and observing the operation of the armature. If there is no short

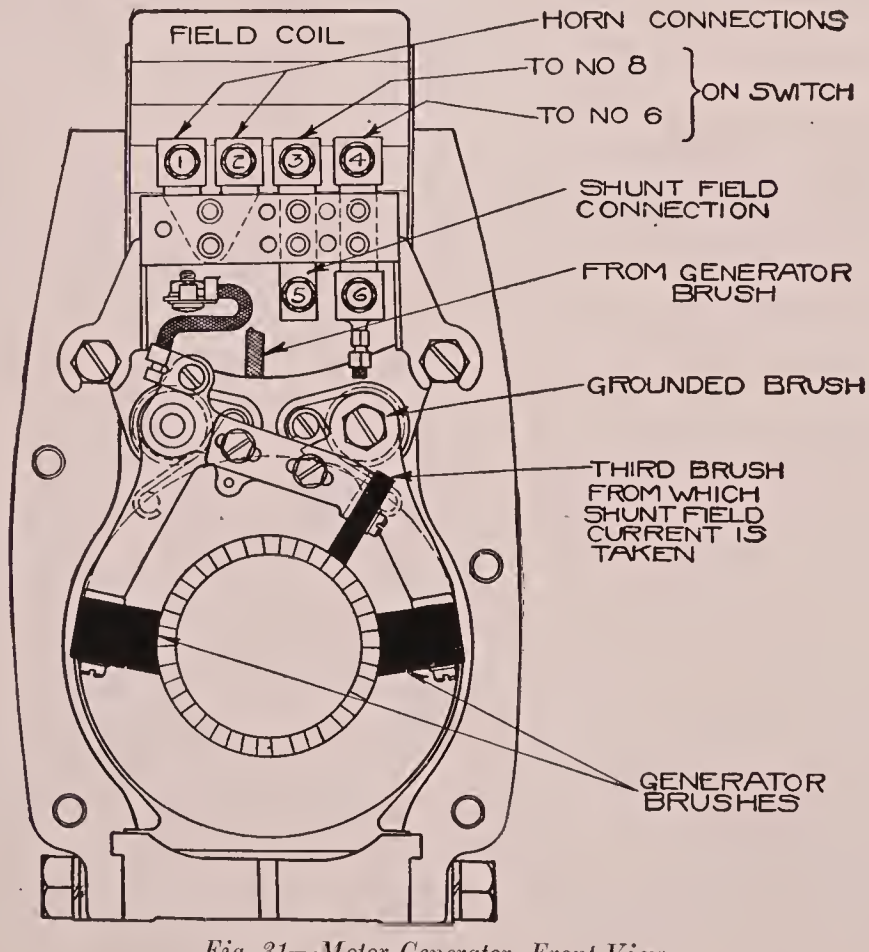


Fig. 31—Motor Generator, Front View.

circuit, open circuit or ground in the generator field windings, the armature will rotate at between 175 and 300 revolutions per minute. The speed at which the armature should rotate depends upon the state of charge of the storage battery. If there is a short circuit, open circuit, or ground in the generator armature windings, the armature will rotate with a jerky motion.

Test the motor field circuit and the motor armature circuit by turning on ignition, pushing down on the starter pedal and immediately switching off the ignition. Before making this test be sure that the battery is in a charged condition, the motor commutator is clean, the brushes bear properly on the commutator, and that all electrical connections are tight. If the engine turns freely, the motor generator should crank it over at approximately 90 revolutions per minute.

To determine if either generator bearing is noisy, remove the generator drive shaft, and turn on ignition.

Testing the Motor Generator. (Off Car.)

If the motor generator is not on the car the foregoing tests may be made by connecting one wire from a charged six volt storage battery

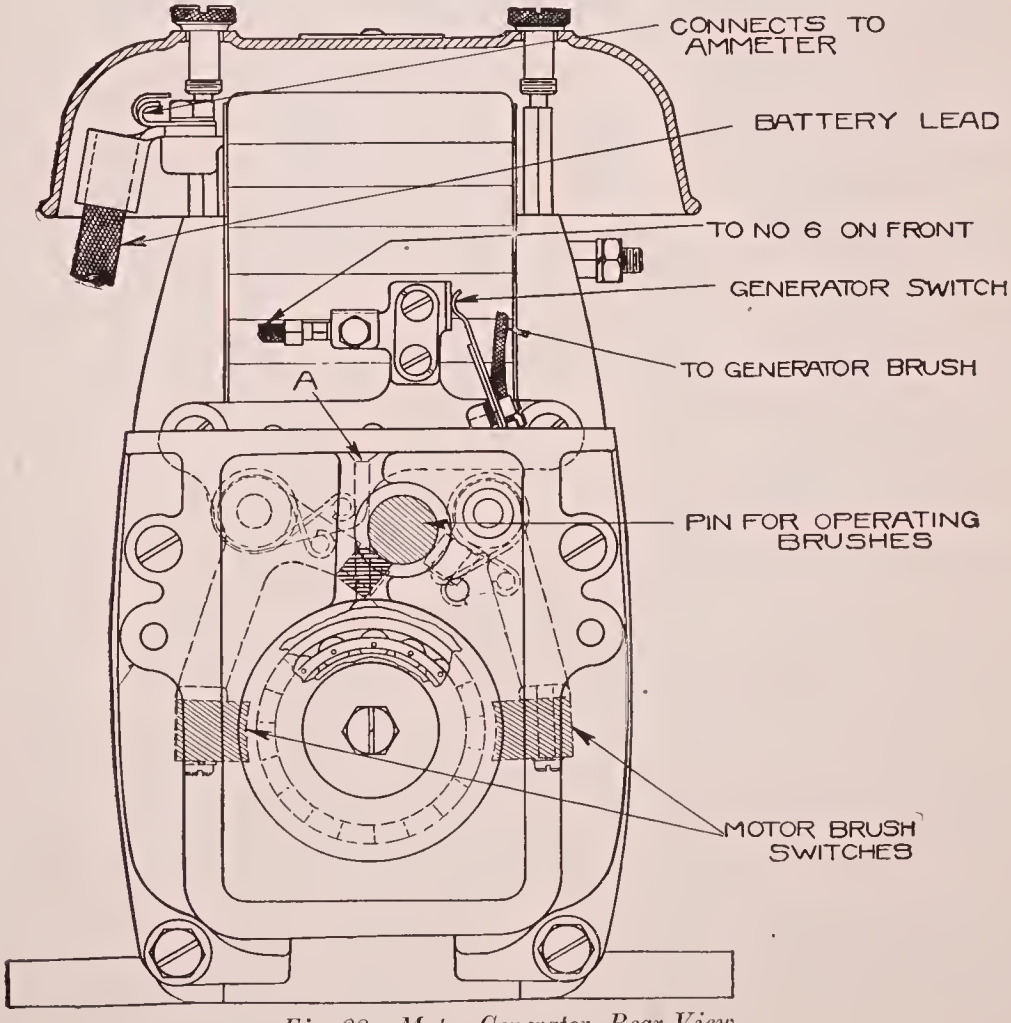


Fig. 32—Motor Generator, Rear View.

to number four terminal on the motor generator, Fig. 31, connecting together terminals three and four and connecting the other wire from the battery to the frame of the generator. Test the generator windings with the motor brushes lifted. Test the motor windings with the motor brushes against the commutator and the generator switch open. Operated as a motor, the armature should rotate at high speed.

Removal and Disassembly of Driving Clutch

The driving clutch may be removed without removing the generator from the engine.

Remove the carburetor. (See "Removal" under "Carburetor," page 105.)

Remove the generator drive shaft.

Remove the large cap screw in the end of the armature shaft and with puller, tool 65493 furnished by the Cadillac Motor Car Company, remove the complete clutch.

The clutch may be disassembled by removing the locking wire in the space "B," Fig. 33. The ends of the wire come together at a recess "A." The wire can be removed by picking out one end of it with a

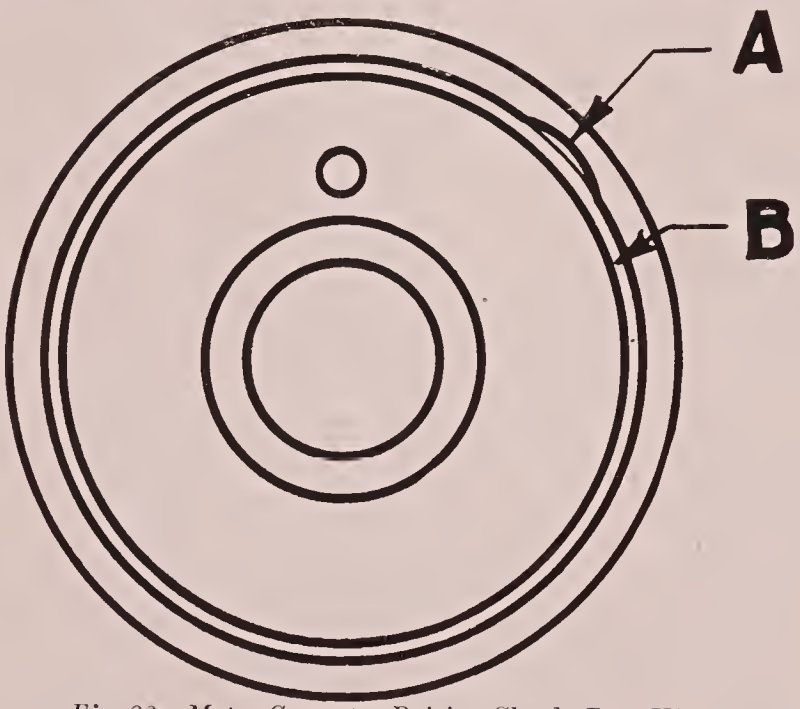


Fig. 33—Motor Generator Driving Clutch, Rear View.

sharp pointed instrument and then removing the entire wire. In replacing the wire make sure that the ends come together at the recess "A."

Removal of Generator Brushes

The brushes which bear on the generator commutator may be removed without removing the generator from the car. To remove these brushes proceed as follows:

Remove the large cable from the storage battery and block it up with a piece of dry wood to prevent it touching the terminal of the battery.

Disconnect the copper strip running from the field coil to the rear of terminal number five, Fig. 31.

Disconnect, at the terminal on the field coil, the wire from the third brush arm.

Remove the two cap screws holding the terminal bracket and the brush arm bracket in place, and remove the terminal bracket and brush arm bracket with brushes.

Removal of Motor Brushes

To remove the brushes which bear on the motor commutator, remove the generator in accordance with directions under "Removal of Generator" and remove the rear end housing as directed under "Removal of Roller Bearing." The remaining motor brush can then be removed.

Removal of Motor Generator

Disconnect from the storage battery one of the large cables and block it up with a dry piece of wood to prevent it touching the terminal of the battery.

Remove the top cover plate from the motor generator and disconnect the large cable and the five small wires.

Remove the carburetor. (See "Removal" under "Carburetor," page 105.)

Remove the generator drive shaft.

Remove the two filister-head screws holding the motor generator to the starter gear housing.

Remove the three large cap screws which hold the motor generator to the top cover plate and remove the motor generator. Exercise care in removing not to drop the brush control pin.

Removal of Annular Ball Bearing

Remove the motor generator. (See "Removal of Motor Generator," on this page.)

Remove the driving clutch. (See "Removal and Disassembly of Driving Clutch," page 96.)

Remove the four cap screws holding the aluminum front housing in place and remove the housing.

To remove the ball bearing from the housing, first remove the four machine screws which hold the bearing retainer in place, then tap out the bearing.

Removal of Roller Bearing

Remove the motor generator as directed under "Removal of Motor Generator," above.

Remove the left-hand motor brush arm. This is the one which is not attached to the rear end housing.

Remove the four cap screws holding the rear end housing in place, and remove the housing complete with armature and bearing.

Remove the four small machine screws which hold the bearing retainer to the housing and remove the housing.

The mounting for the roller bearing can be removed by tapping it out through the two small holes provided.

Removal of Field Coils

Remove the motor generator in accordance with directions under "Removal of Motor Generator," page 97.

Remove the rear end housing with armature as directed under "Removal of Roller Bearing," page 97.

Remove the front housing with bearing.

Remove the terminal bracket and the brush arm brackets.

The coils can now be removed by taking out the long bolt which passes through the coils and holds the two sides of the frame together.

Inspection

Examine the commutators. Burnt or blackened segments of the generator commutator indicate high mica, a short circuit, ground, open circuit or insufficient spring tension on the brushes. If the commutators require it, place the armature between lathe centers and turn them down. Turn off no more than is necessary to clean up the commutators. If the mica between the segments of the generator commutator is above the surface against which the brushes press, or $\frac{1}{64}$ inch or less below, cut the mica down so that it is $\frac{1}{32}$ inch below the surface. Use a hack saw blade ground off on the sides of the teeth so that it will cut a slot between the segments, very slightly wider than the mica. Remove the sharp edges on the segments with a fine three cornered file but do no more than take off the sharp edges.

Examine the insulators on the terminal board, particularly the one which holds terminals numbers four and six, Fig. 31.

Inspect the ball and roller bearings. The races of the ball bearing should rotate smoothly and quietly and should have no more than .005 inch radial play and no more than .015 inch end play. The roller bearings should have no more than .005 inch radial play. The rolls should be free from pits and not chipped on the ends.

The generator and motor brushes should have good bearing on the commutators; if not they should be refitted. (See "Fitting Motor Generator Brushes," page 18.)

The tension of the coil springs on the brush arms should be sufficient to cause a brush pressure of between twenty-five and thirty ounces on the generator commutator, and between thirty and thirty-six ounces on the motor commutator. The pressure between the third brush and the generator commutator should be sixteen to twenty ounces.

Replacement

Make certain that all connections are clean and well tightened.

Before replacing either bearing, fill it well with light cup grease.

The third brush should be so adjusted that the maximum output of the generator is twenty amperes, this means eighteen amperes when current for ignition is deducted. (See "Current Regulation," page 27.)

DISTRIBUTOR HEAD

Removal

Remove the aluminum cap covering the distributor head. The cap may be removed by lifting it straight up after the two small screws are removed which hold each conduit bracket to the cap and the bail over the top of the cap is pushed to one side.

Press back the finger of the clip on the left-hand side of the distributor head and rotate the head in a counter-clockwise direction until the clips on opposite sides register with the flat places on the head.

Remove the distributor head by lifting it straight up and then to one side. Be careful not to catch the rotor button, and thus injure the rotor button spring.

If it is desired to remove the distributor head from the high tension wires, unscrew the nine terminals.

Inspection

INSPECTION OF DISTRIBUTOR HEAD—Clean the head with gasoline and wipe it off with a clean cloth.

The track against which the rotor button presses should be smooth and clean. Clean with a piece of cloth moistened with vaseline, then polish with a dry cloth. Do not use sand paper, emery cloth, or anything of that nature.

Make sure that the contact in the center of the head works freely in its guide.

INSPECTION OF OTHER PARTS—Inspect the rotor button and rotor button spring. (See "Inspection of Rotor" under "Distributor Rotor," page 100.)

Replacement

In replacing, reverse the operations under "Removal."

DISTRIBUTOR ROTOR

Removal

Remove the distributor head. (See "Removal" under "Distributor Head," on this page.)

Remove the rotor by lifting it straight up. If the rotor sticks on the shaft it may be forced off by the use of two small screw drivers. The rotor is recessed on the under side at two points to receive screw drivers in removing. Lift both sides evenly and carefully.

Inspection

INSPECTION OF ROTOR—The upper face of the rotor button should be smooth and clean. If it is necessary to clean it use an oil stone.

Inspect the rotor spring for tension. In replacing the spring make sure that it bottoms in the hole which receives it, otherwise the resulting increased pressure will cause cutting in the distributor head. Under a pressure of between five and ten ounces the rotor button flange should just rest on the rotor.

INSPECTION OF OTHER PARTS—Inspect the distributor head. (See "Inspection" under "Distributor Head," page 99).

Inspect the timer contact points. If they are burned or pitted or out of adjustment, see under "Adjustment of Timer Contact Points" page 23.

Replacement

To replace the rotor, reverse the operation under "Removal," first making sure that the shaft over which the rotor sets, as well as the hole in the rotor which receives the shaft, is clean. If the rotor fits tightly tap it lightly at the center with the wooden end of a screw driver.

DISTRIBUTOR AND TIMER

Removal

Remove the carburetor. (See "Removal" under "Carburetor," page 105).

Remove the generator shaft "A," Fig. 22.

Remove the coupling "C" from the rear end of the fanshaft. To do so first remove the large cap screw "B," then remove the coupling with a puller.

Remove the two cylinder head nuts which hold the brackets of the left-hand high tension conduit. Loosen the small screws in the brackets which hold the right-hand conduit. Remove the distributor head and the low tension wire and lift the left-hand conduit with wires and head over to the right side.

Remove the distributor rotor. This may be done by lifting it straight up. If the rotor sticks on the shaft, force it off with two small screw drivers. The rotor is recessed on the under side at two points to receive drivers in removing. Lift both sides of the rotor evenly and lift it carefully.

Remove the dowel pin "X," Fig. 34, by tapping it out from the front.

Remove the spark control rod.

Remove the three bolts and two nuts which hold the distributor and timer to the fan shaft housing.

The distributor and timer may now be removed by tapping it lightly. As the dowel pin "Y" is still in position, care must be exercised to remove both sides evenly.

Removal of Plain Bearing

Remove the cotter pins "G" and "H," Fig. 7, and the contact arms "C" and "O," being careful not to bend the posts upon which the arms operate.

Remove the nut "A," the resistance unit, and the condensor "D."

Remove the oiler "W."

Remove the screws "K" "L" and "M" and lift out the segment plate "N."

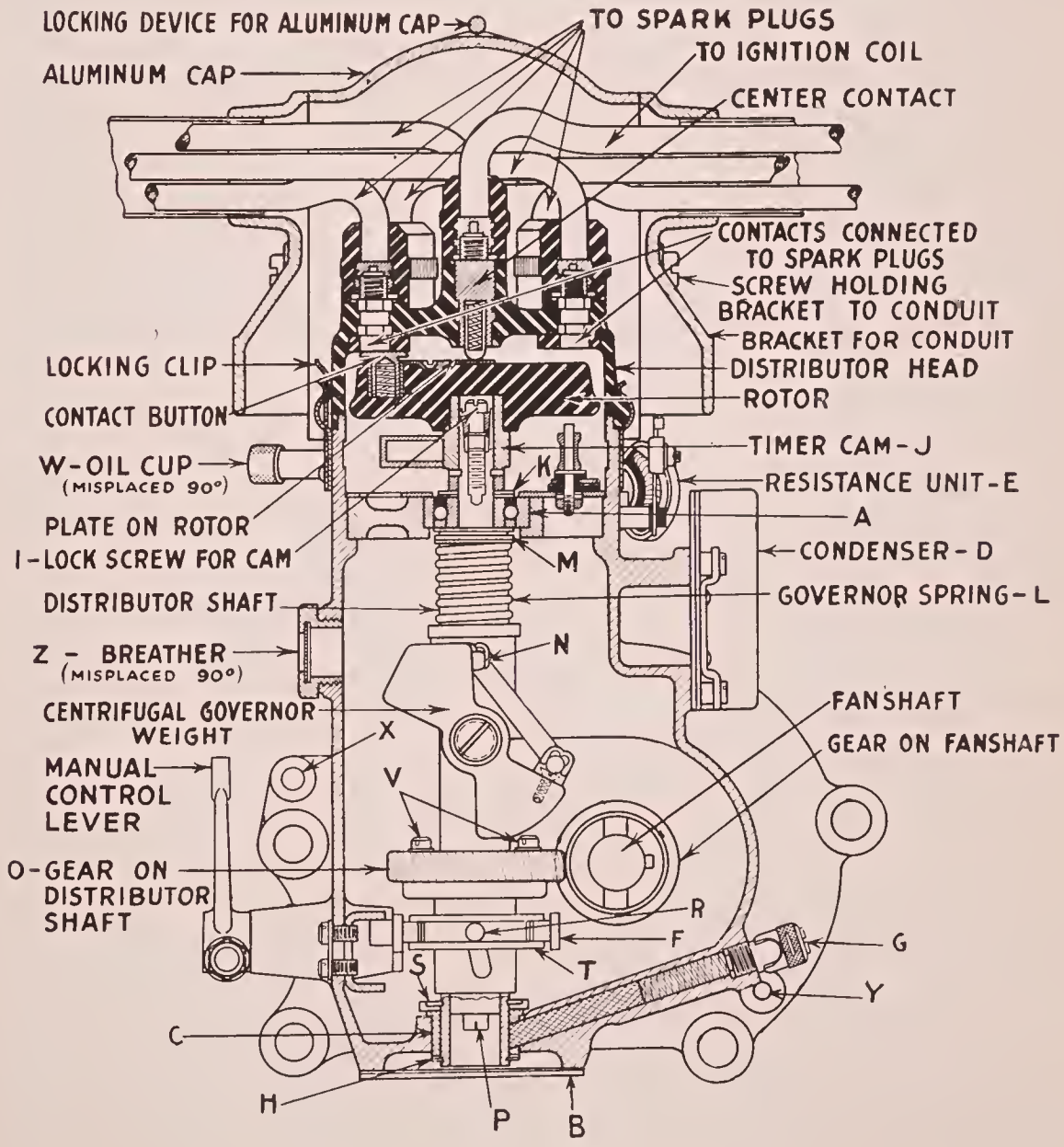


Fig. 34—Distributor and Timer, Sectional View.

Remove the headless screw in the yoke "F," Fig. 34, and remove the yoke and shaft to which it is attached.

Remove the oiler "G" by unscrewing it and pull out the oiler spring.

Remove the plate "B."

Remove the locking washer "H."

Remove the distributor shaft complete by pulling it out through the top of the housing.

The bushing "C" can now be removed by tapping it out carefully. In replacing the bushing be sure that the hole for the oiler wick is opposite the hole in the housing for the wick.

Removal of Annular Ball Bearing

Remove the distributor shaft as directed under "Removal of Plain Bearing, page 101."

Loosen the lock screw "I" and remove the cam "J." Fig. 34.

Remove the locking washer "K" and lift out the two steel washers and the left washer.

Remove the ball bearing by tapping it off carefully.

Removal of Spring

Remove the distributor shaft as directed under "Removal of Plain Bearing, page 101."

Remove the pin "N," Fig. 34, and pull out the shaft with the ball bearing.

Remove the locking washer "M" and remove the spring.

Removal of Gear

Remove the distributor shaft complete in accordance with directions under "Removal of Plain Bearing, page 101."

Remove the screw "P" and drive out the straight pin "R," Fig. 34.

Remove the locking washer "S" and the collar "T."

Remove the locking washer held to the spiral gear "O" by the screws "V." The gear with sleeve can now be removed from the shaft. The gear is held to the sleeve by a taper pin.

Inspection

Check up the amount of side play in the annular ball bearing "A," also in the plain bearing "C." The side play in the ball bearing should not exceed .003 inch. The side play in the plain bearing should not exceed .004 inch.

The ball bearing should rotate smoothly and quietly.

Examine the spring. The spring should compress to .956 inch under a load of between eleven and twelve ounces and to .500 inch under a load of between three pounds seven ounces and four pounds three ounces.

Examine the teeth of the gear "O" and those of the gear with which it meshes.

Examine the timer contact points. They should be clean, fit squarely against each other, and in proper adjustment. (See under "Adjustment of Timer Contact Points, page 23.")

The tension of the springs on the contact arms should be great enough to cause a pressure of eighteen to twenty ounces between the contact points.

INSPECTION OF OTHER PARTS—Inspect the distributor rotor. (See "Inspection of Rotor" under "Distributor Rotor, page 100.")

Inspect the distributor head. (See "Inspection of Distributor Head" under "Distributor Head," page 99.)

Replacement

To replace, reverse operations under "Removal."

After replacing the distributor and timer remove the breather "Z" and place ten ounces of number two cup grease in the housing.

Retime the ignition in accordance with directions under "Timing Ignition," page 23.)

Exercise care, in replacing the distributor head, not to catch the rotor button on the side of it, also to make sure that the head fits down evenly and that it is locked in place.

COOLING SYSTEM

RADIATOR

Removal

Remove the wires from the head lamps. To do so lift up the connectors to which the wires are attached, turn them slightly in the counter-clockwise direction and pull them down.

Disconnect at the head lamps the small rods running from the lamps through the radiator casing.

Remove the two cap screws holding each lamp bracket to the fender support and remove the lamps with brackets and tie rod.

Drain cooling system. (See under "Draining the Cooling System," page 34.)

Remove the hood.

Remove the cross shaft attached to the rear face of the radiator.

Disconnect the tie rod at the radiator by removing the cap screw.

Remove the cotter pins, nuts and springs from the two studs which hold the radiator to the frame.

Disconnect the five radiator hose connections.

Remove the radiator by pulling its upper end forward slightly, then lifting it up.

Inspection

Inspect the radiator for leaks. To do so proceed as follows: Plug the four large hose connections on the radiator and screw on and tighten the radiator filler cap. Attach an air hose to the lower end of the radiator over-flow pipe, immerse the radiator in water and turn on air under a pressure of approximately fifteen pounds. Leaks are indicated by air bubbles.

Radiator repair should be attempted only by men who have had experience in this line of work. The following suggestions will assist in repairing a Cadillac radiator:

If a tube leaks where it is soldered to the upper or lower header, resolder it on the inside of the header. This may be done after removing the radiator casing which is held in place by ten small bolts, and removing the tank by unsoldering. If it is necessary to replace a tube, remove both tanks by unsoldering, lay the radiator down flat, and with a blow torch melt the solder the entire length of the tube to be removed. The tube can then be pulled out. Before putting in a new tube, tin it its entire length. After the tube is in place and the fins are lined up, solder the tube to the fins, using a blow torch. With a soldering iron, solder the ends to the headers.

Whenever radiator tanks are removed for any purpose, it is a good plan to test all of the tubes. Test each tube separately by plugging one end and forcing air under approximately fifteen pounds pressure into the open end, while the radiator is immersed in water.

Inspect the radiator fins. They should be parallel to each other and equally distant from each other. To insure maximum radiator efficiency, each fin must be soldered to each tube.

Replacement

Before replacing radiator flush it out with water and remove the radiator strainers and clean them.

In replacing, reverse operations under "Removal."

Unless the radiator is properly lined up the hood will not fit properly. The radiator is lined up by increasing or decreasing the number of shims upon which it rests, and by altering the length of the rod which ties it to the body of the car.

WATER PUMP STRAINERS

Removal

There is a strainer in each outlet at the bottom of the radiator. Holes are provided in the lower part of the front face of the radiator shield permitting easy access to the screw caps which cover them.

To remove the strainers first drain the cooling system, (see under "Draining the Cooling System," page 34), then remove the caps by unscrewing and pull the strainers out.

An offset socket wrench should be used in removing the caps.

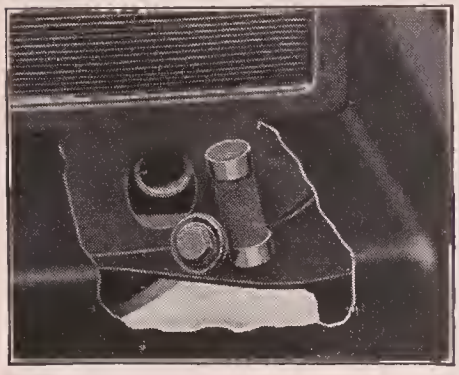


Fig. 35—Removal of Left-Hand Water Strainer.

Inspection

Inspect the strainers. They should be clean and in good condition.

Replacement

Before replacing the strainers it is a good plan to flush out the radiator by allowing water from a hose to run through it.

After replacing the strainers make sure that the screw caps are well tightened against the lead gaskets.

Refill the cooling system in accordance with directions under "Filling the Cooling System," page 34.

GASOLINE SYSTEM

CARBURETOR

Removal

Relieve the pressure in the gasoline system by removing the gasoline tank filler cap.

Shut off the gasoline at the tank and replace the cap.

Disconnect the gasoline feed pipe at the carburetor.

Loosen the clamp screw holding the drain pocket under the carburetor and force the pocket down.

Remove the carburetor control rods at the carburetor.

Remove the two cap screws which hold the carburetor to the intake manifold and remove the carburetor.

Disassembly

Remove the carburetor bowl. To do so, proceed as follows: Remove the pin "Z," Fig. 36. Remove the screw "C" and the packing gland "D" with packing.

Remove the throttle pump plunger "W." To do so, first remove the cap "B" by rotating it in either direction one-eighth turn or more, then lift it straight up. Then pull out the plunger.

Remove the spray nozzle "E" by unscrewing it, and the cork float "F." The float can be removed after the hinge pin is pulled out.

Remove the diaphragm from the carburetor body. This may be done after removing the three long screws which hold these parts together.

Inspection

Inspect the face of the carburetor body which bolts against the intake manifold. This face must be in good condition and perfectly flat to insure against air leaks when the carburetor is bolted in place.

The throttle "G" must move freely from the open to the closed position. When the disc is squarely across the mixing chamber the sum of clearances on opposite sides of the disc should be no more than .007 inch. Greater clearance will make it impossible to throttle the engine down to the recommended speed of 300 revolutions per minute. Also make sure that the disc is not bent and that the small screw holding it in place is well tightened.

End play in the throttle shaft should not exceed .004 inch. Clearance between the throttle shaft and the bronze bushings in which it operates should not exceed .010 inch.

The shutter attached to the throttle shaft should clear the face of the carburetor body, but have no more than .005 inch clearance. Greater clearance will interfere with the operation of the leaning device.

The shaft of the automatic throttle "H" must work freely in its bearings. Test this by rotating the shaft approximately 180 degrees

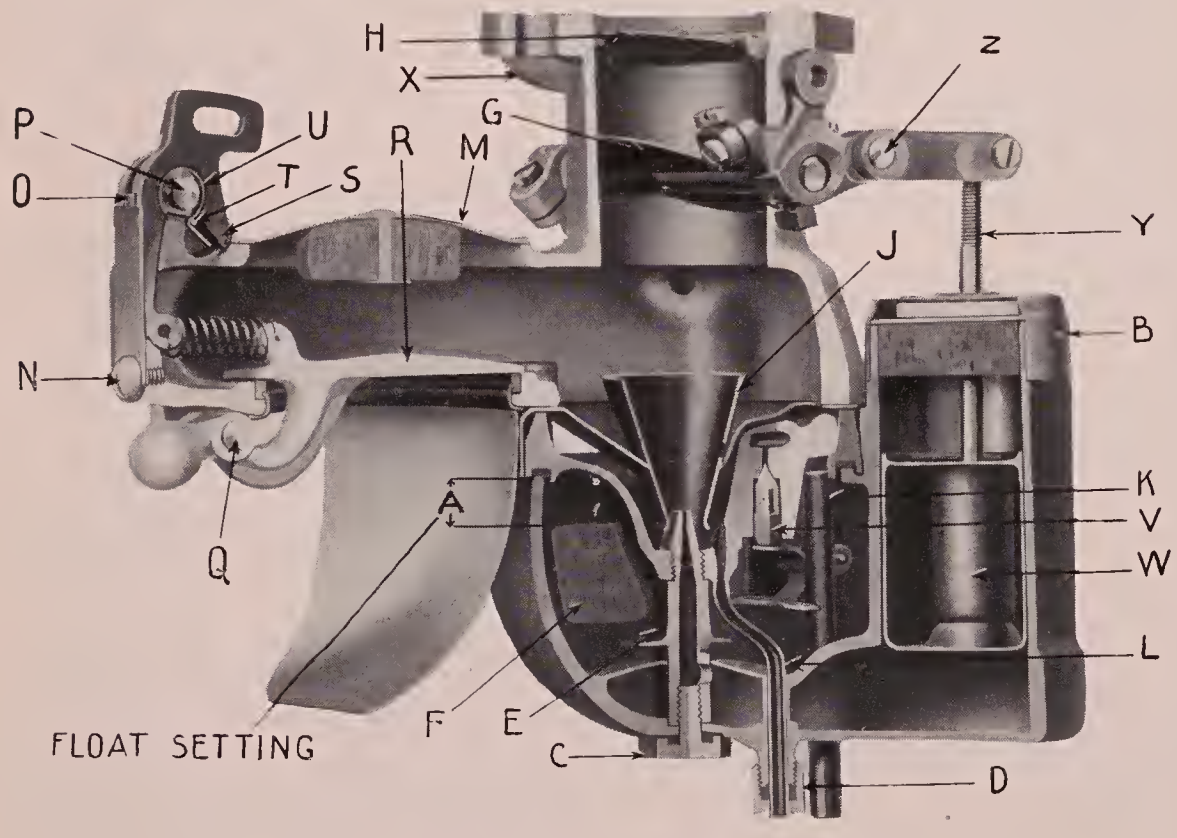


Fig. 36—Carburetor, Sectional View.

from the normal position and allowing it to return slowly. If there is any tendency of the shaft to stick, remove it in the following manner and clean the bearings: Remove the two small screws holding the plate "X." Remove the small screw holding the throttle disc to the shaft and remove the disc. Remove the shaft, being careful not to damage the spring.

After making sure that the shaft of the automatic throttle works freely in its bearings, check up the tension of the spring on this shaft. This may be done with tool number 67327, furnished by the Cadillac Motor Car Company, or with six and seven-eighths inches of number 14 copper wire (.064 inch in diameter) bent in shape shown in Fig. 37,

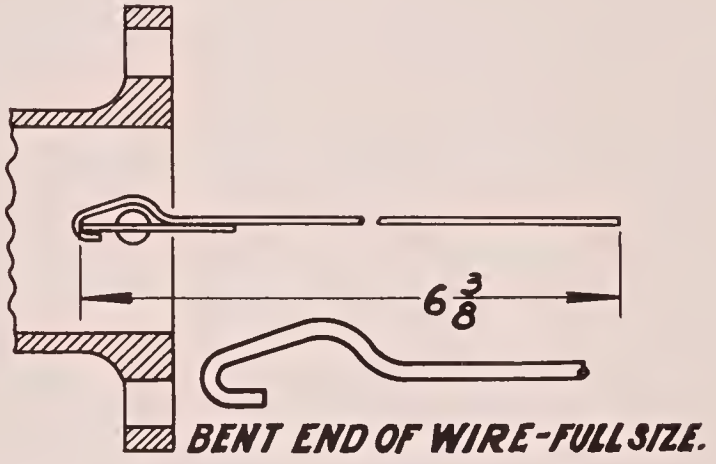


Fig. 37—Testing Spring of Carburetor Automatic Throttle.

hooking it over the throttle as shown, and with the carburetor in the horizontal position, noting the position which the throttle disc assumes. The disc should assume the horizontal position. If it does not and you are sure that the throttle shaft is free in its bearings, slightly loosen the screws holding the plate "X," Fig. 36, and turn the large adjusting cap. Turning this cap in the clockwise direction increases the tension of the spring; turning it in the counter-clockwise direction decreases the tension.

Make sure that the conical tube "J" is firmly fastened to its support.

Inspect the cork gasket against which the carburetor bowl presses. Also inspect the edge of the bowl which bears against the gasket. The gasket and the edge of the bowl must be in good condition.

Examine the tube which runs between the carburetor diaphragm and carburetor body. Also tubes "K" and "L." These tubes must not be crushed or obstructed in any way.

Remove the air valve spring and check it up. To remove proceed as follows: Remove the cover plate "M." Loosen the screw "N" and slide the cover "O" to one side. Remove the pins "P" and "Q."

This will make it possible to so place the air valve "R" and the lever "S" that the spring may be removed without injuring it. The spring should have a free length of 1.040 inches to 1.080 inches and support a weight of four and three-fourths ounces avoirdupois when compressed five-sixteenths inch. When replacing the spring, insert the ends from the side of the lever and the side of the valve boss, which are nearest the adjusting screw "A," Fig. 13.

When replacing the lever "S," Fig. 36, be sure that the pin "T" is between the spring "U" and the lever "S." Also that the tongue at the upper end of the cover "O" does not bear against the lever.

The auxiliary air valve "R" must swing freely on the pin "Q" and must rest on the pin, not on the leather seat over the pin. The clearance between the valve and the leather seat at a point directly over the pin should be from one sixty-fourth inch to three sixty-fourths inch when the tip of the valve is seated.

The leather air valve seat should be in good condition. If replacement is necessary use tool number 55405 furnished by the Cadillac Motor Car Company.

The lever "S" must work freely in its guide. Test this by unscrewing the adjusting screw "A," Fig. 13, until the notches are free from the locking plunger, then forcing the upper end of the lever forward (away from the neck of the carburetor) as far as it will go and allowing it to return slowly to the normal position. The lever should be sufficiently free in its guide so that a normal spring in the lever arm will return it until its lower end touches the cover "O," Fig. 36.

The inlet needle valve "V" and its seat should be inspected carefully. The valve and seat should be clean and free from pits. The valve should be free from wear, which causes a shoulder on the tapered portion and results in a slow leak.

After replacing the diaphragm, inlet needle valve and carburetor float, set the float in accordance with directions in this book under "Setting of Carburetor Float," page 39. While holding the carburetor upside down observe the clearance between the float lever and the lower end of the needle valve guide. This clearance should be no less than .035 inches. If the required clearance does not exist, remove the float and valve and, with a mill file, file squarely across the guide. Be sure to remove all filings before replacing valve and float.

Remove the strainer at the carburetor inlet. Clean the strainer and inspect it.

Inspect the machined surface of the diaphragm against which the spray nozzle screws, also the machined surface of the nozzle which screws against the diaphragm. These surfaces must be in good condition. Replace the nozzle and tighten.

The throttle pump plunger "W" should work freely the entire length of the pump well, but the clearance should not exceed .006 inch.

To prevent the float striking it, the vent tube "K" must stand parallel with the bore of the throttle pump cylinder. The top end of the tube should stand nine sixty-fourths inch away from the edge of the bowl.

Replace the carburetor bowl, tightening the screw "C" before tightening the gland "D." If the adjustment of the rod "Y" has been altered re-adjust it so that its upper end is flush with the top face of lever to which it is attached.

Replacement

In replacing the carburetor reverse operations under "Removal." Be sure that the gasket between the carburetor and intake manifold is in good condition and that the cap screws holding the carburetor to the manifold are well tightened, also that the rod running from the steering post to the lever "S" stands in the center of the slot in the lever, when the auxiliary air valve lever on the steering post is pushed down as far as it will go. This rod is adjusted at the lever on the steering post.

After the carburetor is in place do not neglect to pull up the drain pocket tightly under it and lock it in place with the small set screw.

Adjust carburetor in accordance with directions under "Adjustment of Carburetor," page 37.

POWER AIR COMPRESSOR IN THE GASOLINE SYSTEM

Removal

Disconnect the air pipe from the compressor by unscrewing the union.

Remove the two one-fourth inch nuts and washers and remove the compressor body.

Crank the engine over until the compressor piston is at the top of its stroke.

Remove the piston with connecting rod by sliding the connecting rod forward, then upward.

Inspection

Clean all parts with kerosene or gasoline and with a cloth wipe out the cylinder and wipe off the piston.

The cylinder and piston should be free from scores. There should be no more than .003 inch clearance between these parts.

There should be no more than .002 inch clearance between the piston pin and the piston and no more than .003 inch between the bearing at

the lower end of the connecting rod and the eccentric upon which it operates.

Dissemble the check valve on the pump and thoroughly clean the valve and valve seat.

Replacement

Wipe out the cylinder, wipe off the piston and lubricate these parts with engine oil of a suitable quality before replacing.

See that the check valve stands in the upright position.

In replacing, reverse operations under "Removal."

GASOLINE TANK

Removal of Gasoline Quantity Gauge

To remove the gasoline gauge, first remove the large nickel plated nut and the glass. The gauge can then be lifted out with a pointed tool inserted in the hole in the dial. Care must be exercised not to injure the cork gaskets.

Removal of Tank

Relieve the tank of all air pressure by removing the filler cap.

Remove the drain plug and drain the tank.

Disconnect the air and gasoline pipes from the tank by unscrewing the unions.

The tank can now be removed after removing the nut at the rear and the cotter pins and the two nuts at the front and pushing the tank forward. In removing the two forward nuts observe the manner in which the washers are placed. These washers must be replaced as originally assembled.

Removal of Gasoline Strainer

Remove the gasoline tank. (See on this page under "Removal of Tank.") This is necessary on all cars with the exception of touring cars. Touring cars are provided with a removable floor over the tank.

Remove the cotter pin from the valve stem. Remove the packing gland and remove the valve by unscrewing it.

Remove the four small cap screws and remove the connection plate with strainer and stand pipe.

Inspection

With the gasoline tank removed test it by screwing on and tightening the filler cap, replacing the drain plug, temporarily plugging the nipple from which the gasoline pipe was disconnected, attaching an air hose to the nipple from which the air pipe was disconnected, and with the tank immersed in water turning on an air pressure of approximately six pounds. As the valve on the gasoline tank is

open under normal conditions it should be open during this test. Do not use a pressure greater than six pounds.

Test the gasoline quantity gauge by draining the gasoline tank, then refilling it with five measured gallons of gasoline. The gauge should indicate five. If it does not, remove it as directed under "Removal of Gasoline Quantity Gauge," page 110, and slightly bend the float arm.

Examine the valve and the valve seat. These should be in good condition.

Replacement

In replacing the stand pipe in the gasoline tank be sure that its lower end enters the hole in the support.

In replacing the washers on the forward tank supports make sure that they are replaced as originally assembled. When assembled correctly, a spherical joint is provided at the bottom of each forward support.

Before replacing the connection plate make sure that the gasket is in good condition.

CLUTCH AND TRANSMISSION

TRANSMISSION CASE

Removal

Remove and disassemble the transmission. (See "Removal and Disassembly" under "Transmission," pages 121 and 122.)

Inspection

With kerosene or gasoline clean all parts removed.

INSPECTION OF TRANSMISSION CASE—Carefully examine the transmission case and inspect all machined surfaces.

INSPECTION OF OTHER PARTS—Before replacing, inspect all parts removed in accordance with directions in this book.

Replacement

After inspecting all parts, reassemble and replace the transmission. (See "Reassembly and Replacement" under "Transmission," page 123.)

Refill the transmission with three quarts of suitable transmission lubricant. Cadillac Rear Axle and Transmission Lubricant is recommended.

CLUTCH

The amount of wear on the clutch discs may be determined roughly, by noting the distance which the ends of the six studs "V," Fig. 39, project beyond the retainer plate "W." This inspection may be made after removing the floor boards and the hand hole plate "X." If the ends of the studs project more than one-half inch beyond the retainer plate, the clutch discs should be removed and recovered.

Removal of Clutch

Remove the transmission. (See "Removal" under "Transmission," page 121.)

Remove the nut "T" and pull off the clutch.

Removal of Ball Thrust Bearing

Remove the clutch. (See on this page under "Removal of Clutch.")

Remove the retainer which holds the thrust bearing to the clutch spider and remove the bearing. Ordinarily the bearing can be removed by pulling it off by hand.

Removal of Clutch Spring

Remove the clutch. (See on this page under "Removal of Clutch.")

Place the clutch under an arbor press with the ball thrust bearing up. Place a block of wood over the upper end of the clutch spider and with the arbor press slightly compress the clutch spring.

Remove the nuts from the six long studs "V," Fig. 39.

Remove the clutch from the arbor press and remove the clutch spider and clutch spring.

Removal of Clutch Discs

Remove the transmission. (See "Removal" under "Transmission," page 121.)

Compress the clutch spring by pushing down on the clutch pedal and place a piece of metal five-eighths inch long between the screw collar which locks the rear annular ball bearing to the clutch connection shaft and the rear face of the clutch spider.

Remove the nuts from the six long studs "B" and remove the clutch discs.

Inspection

Examine the ball thrust bearing. If the bearing is noisy or feels rough in spinning the races, replace it by a new one.

Be sure that the bearing is well filled with suitable lubricant. Cadillac Rear Axle and Transmission Oil is recommended.

The clutch spring should have a minimum free length of seven and one-half inches and should support a load of from 290 to 310 pounds when compressed to three and one-quarter inches.

Examine the clutch discs. There should be no more than .008 inch clearance between the driven discs and the keys of the clutch hub, and no more than .010 inch clearance between the teeth of the driving discs and the teeth in the clutch ring.

Examine the linings on the discs. If the total thickness of a disc with the two linings is less than five-sixteenths inch, the disc should be recovered. (See under "Relining Clutch Discs," page 40.)

Warped clutch discs should be straightened or replaced.

Examine the faces of the driven discs.

The six long studs should be tight in the plate to which they are fastened.

The clutch hub should be a sliding fit on the splines of the clutch connection.

Replacement

In replacing, reverse operations under "Removal."

In replacing the discs, make sure that the small reinforcements on the driven discs are on the driving sides of the keys of the clutch hub. Also that the teeth of driving discs line up.

In replacing the nuts on the six long studs, screw them down until their upper faces are just flush with the ends of the studs.

TIRE AIR COMPRESSOR

Removal

Remove the floor boards.

Remove the drain plug "Q," Fig. 39, and drain the transmission.

Remove the copper pipe which connects the compressor and the frame of the car.

Remove the pull back spring from the connecting link on the compressor shifter shaft.

Remove the set screw which holds the shifter shaft in place and remove the shaft with connecting link.

Remove the four nuts which hold the body of the compressor to the transmission case and remove the compressor.

Disassembly

Remove the plate at front end of the crankcase of the compressor, Fig. 38.

Remove the nut at the top of the compressor cylinder, also the valve and spring.

Remove the four machine screws holding the cylinder in place and remove the cylinder.

Remove the two pieces of felt and the felt retainers.

Remove the connecting rod with piston. With the piston at the highest point in its stroke the connecting rod can be removed by sliding it forward.

Remove the locking ring at the rear of the forward crankshaft bearing and pull out the crankshaft.

To remove the shifter yoke from the shaft, drive out the taper pin between these parts. The taper pin can be driven out after removing the small machine screw in the side of the case.

The bushings in which the crankshaft rotates can be removed by tapping them out.

The piston pin can be removed by first pulling out the cotter pin, then lightly tapping it out.

Inspection

Clean all parts with kerosene or gasoline.

Inspect the cylinder bore. It should be free from scores.

Clearance between the piston and cylinder should not exceed .006 inch.

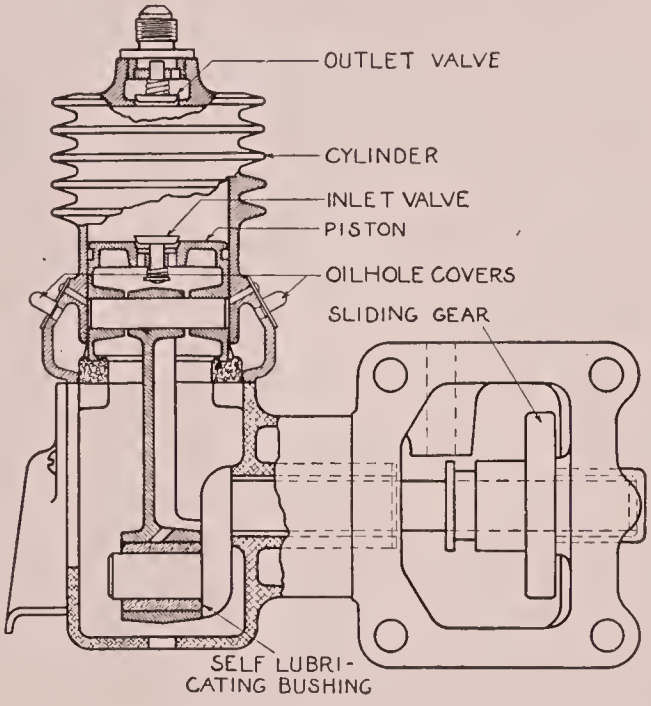


Fig. 38—Tire Air Compressor, Sectional View.

The clearance between the crankshaft and its bearings should not exceed .004 inch.

The clearance between the crankshaft and the driving gear should not exceed .005 inch.

Inspect the teeth of the driving gear.

The clearance between the piston pin and the piston should not exceed .003 inch.

The clearance between the crank pin bearing and the crank pin should not exceed .004 inch.

Placed on lathe centers, the crankshaft should run true within .002 inch.

Inspect the felts. They should be in good condition and well soaked with engine oil.

Inspect the inlet and exhaust valves, regrinding them if necessary.

Inspect the intake and exhaust valve springs. The intake and exhaust valve springs should have a free length of one-half inch. When the valve is opened one-sixteenth inch, the exhaust valve spring should show a pressure of seven and one-half ounces, the inlet valve spring four and one-half ounces.

Replacement

In replacing, reverse operations under "Removal."

After replacing the drain plug "Q" refill the transmission with suitable transmission lubricant. Cadillac Rear Axle and Transmission Lubricant is recommended. Two quarts of lubricant are required.

CLUTCH CONNECTION AND CLUTCH CONNECTION REAR BEARING

Removal

Remove the clutch. (See "Removal of Clutch" under "Clutch," page 112.)

Remove the transmission cover plate.

Remove the six cap screws which hold the clutch connection bearing cap in place, and remove the clutch connection with bearing.

Remove the locking ring which holds the check nut in place and remove the nut (left-hand thread).

Remove the oil throw-off ring.

The bearing can be removed from the shaft by tapping it off.

Inspection

With gasoline or kerosene clean all parts removed.

Inspection of the Clutch Connection and Rear Bearing—Examine the clutch connection. Placed between lathe centers it should run true within .0025 inch. The bore in which the roller bearing operates should be smooth and free from pits. The faces of the gear teeth should show very little wear and should be free from pits. The clutch hub should be a light press fit on the splines of the clutch connection.

Inspect rear bearing on the clutch connection. The bearings should rotate smoothly. There should be no more than .015 inch end play in the races.

Inspection of Other Parts—Examine the roller bearing. The rolls should be free from pits and not chipped on the ends.

Examine the ball bearing which supports the forward end of the clutch connection. It should rotate smoothly and quietly and have no more than .015 inch end play. With the clutch connection, main transmission shaft, and roller bearing in place, there should be no more than .004 inch shake between the shaft and the clutch connection.

Replacement

In replacing, reverse operations under "Removal."

SHIPPER GEARS

Removal of High and Intermediate Shipper Gear

Remove the jackshaft. (See "Removal" under "Jackshaft and Jackshaft Gears," page 117.)

Remove the transmission shaft. (See "Removal" under "Main Transmission Shaft and Main Transmission Shaft Rear Bearing," page 120.) In pulling out the shaft do not allow the shipper gears to drop.

The high and intermediate shipper gear can now be removed.

Removal of Low and Reverse Shipper Gear

Remove the jackshaft. (See "Removal" under "Jackshaft and Jackshaft Gears," page 117.)

Remove the main transmission shaft. (See "Removal" under "Main Transmission Shaft and Main Transmission Shaft Rear Bearing," page 120.) In pulling out the shaft do not allow the shipper gears to drop.

Remove the top cover plate.

Remove the right-hand shifter shaft (see "Removal" under "Shifter Forks and Shafts," page 120), and remove the low and reverse shipper gear.

Inspection

With kerosene or gasoline clean all parts removed.

INSPECTION OF GEARS—The clearance between the sides of the splines of the shaft and the sides of the spline ways of the shipper gears should not exceed .004 inch.

The teeth of the gears should show very little wear and be free from pits.

There should be no more than .015 inch between the shifter fork and groove in the gear in which it operates.

INSPECTION OF OTHER PARTS—Inspect the main transmission shaft and its bearings. (See "Inspection" under "Main Transmission Shaft and Main Transmission Shaft Rear Bearing," page 121.)

Inspect the jackshaft gears and bearings. (See "Inspection of Jackshaft and Jackshaft Gears" under "Jackshaft and Jackshaft Gears," page 118.)

Inspect the teeth of the clutch connection gear and of the reverse gear. The faces of the teeth should show very little wear and be free from pits.

Replacement

In replacing, reverse operations under "Removal of High and Intermediate Shipper Gear" and under "Removal of Low and Reverse Shipper Gear," on this page.

Refill the transmission up to the proper level with suitable transmission lubricant. Cadillac Rear Axle and Transmission Lubricant is recommended. Two quarts are required.

JACKSHAFT AND JACKSHAFT GEARS

Removal

Remove the plug "Q," Fig. 39, and drain the transmission.

Remove the bottom cover plate. The plate is held in place by nine five-sixteenth inch nuts.

Determine the amount of end play in the jackshaft. (See under "Inspection of Jackshaft and Jackshaft Gears," page 118.)

Remove the shield over the forward universal joint.

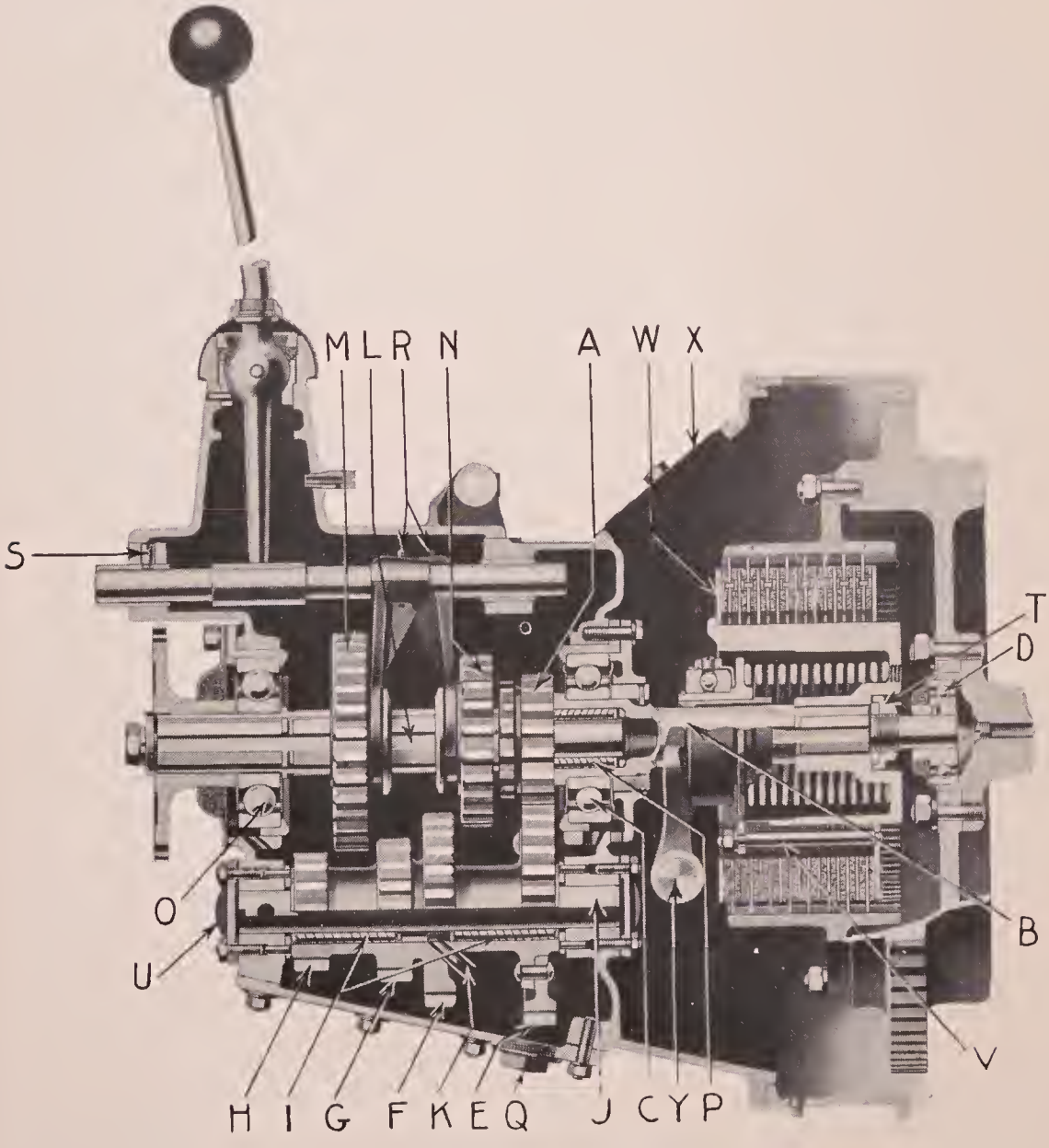


Fig. 39—Clutch and Transmission, Sectional View.

Remove the lower shield bracket.

Remove the cap "U."

Remove the screw which holds the shaft "J" in place.

Remove the shaft "J." To do so, screw a ½ inch x 12 cap screw into the rear end of the shaft and with the cap screw pull out the shaft. Be careful in removing the shaft that neither the jackshaft, nor the spacer washers drop.

Inspection

With kerosene or gasoline, clean all parts removed.

INSPECTION OF JACKSHAFT AND JACKSHAFT GEARS—Inspect the teeth of the gears. Gear teeth faces should show but little wear and be free from pits.

Examine the bore of the jackshaft which carries the gears.

With the roller bearings, and the shaft "J," Fig. 39, in place there should be no more than .004 inch play between the shaft "J" and the jackshaft.

The jackshaft when in place in the transmission should have no more than .015 inch end play.

INSPECTION OF OTHER PARTS—Inspect the roller bearings. The rolls should be free from pits and not chipped at the ends.

Inspect the bearing surfaces of the shaft "J."

Inspect the teeth of the gears which mesh with teeth of the jackshaft gears. The faces of the teeth should show but little wear and be free from pits.

Replacement

In replacing, reverse operations under "Removal."

After replacing the bottom cover plate and the drain plug, refill the transmission with enough transmission lubricant of suitable quality to bring the level up to the filling hole. This will require approximately two quarts. Cadillac Rear Axle and Transmission Lubricant is recommended.

CONTROL LEVER

Removal

Remove the ball at the top of the control lever by unscrewing it.

Remove the nut which holds the nickel plated dust cover in place and remove the dust cover.

Remove the large adjusting collar by unscrewing it and remove the felt washer.

The control lever can now be removed by lifting it out. Care must be exercised not to drop the centralizing pin into the transmission.

Inspection

INSPECTION OF CONTROL LEVER—Inspect the ball on the control lever which supports it. If the ball has been injured clean it up with a fine mill file.

INSPECTION OF OTHER PARTS—Inspect the centralizing pin.

Inspect the felt washers.

Inspect the seat in which the ball of the control lever rests.

Replacement

In replacing, make sure that the centralizing pin is properly in place before replacing the felt washer and screwing down the collar.

REVERSE PINION

Removal

Remove the drain plug "Q," Fig. 39, and drain the transmission.

Remove the tire air compressor. (See "Removal" under "Tire Air Compressor," page 113.)

Determine the amount of end play in the reverse pinion. (See on this page under "Inspection.")

Remove the set screw which holds the reverse pinion shaft in place. This screw is in the left-hand side of the transmission case.

Remove the reverse pinion, being careful not to drop the spacing washer at the rear end of the pinion.

Inspection

With kerosene or gasoline carefully clean all parts.

There should be no more than .004 inch clearance between the bearing in the pinion and the shaft. If it is necessary to replace the bearing press it out and press in the new one. Ream the new bearing to .937 inch to .938 inch after it is in place.

When the gear is in place in the transmission case there should be no more than .015 inch end play.

Inspect the pinion teeth. The faces of the teeth should be free from pits and show very little wear.

Replacement

In replacing, reverse operations under "Removal."

In replacing the pinion have the beveled ends of the teeth forward.

After bolting the tire air compressor in place and replacing the drain plug "Q," refill the transmission case up to the level of the filling plug with transmission lubricant of the proper quality. Cadillac Rear Axle Transmission Lubricant is recommended. Two quarts of lubricant are required.

SHIFTER FORKS AND SHAFTS

Removal

Remove the transmission top cover plate. The plate is held in place by six cap screws.

Remove the threaded dowel pin "R," Fig. 39. To do so place over it a washer large enough to permit the pin to be pulled through it, and screw on and tighten a ¼ inch x 20 nut.

Remove the dowel pin screw "S."

Remove the cotter pin, spring and plunger from the front end of the shifter fork shaft. These are located at each side of the transmission case.

The shaft may now be removed by tapping it out through the rear end of the transmission case, at the same time driving out the rear bearing. There is a nine-sixteenth inch ball between the bearings which support the front ends of the shifter fork shafts. The purpose of the ball is to make it impossible to bring both shipper gears into mesh at the same time. Do not allow this ball to drop into the transmission case, and be sure to remove it in case it does.

Inspection

With kerosene or gasoline clean all parts removed.

Inspection of Shifter Fork and Shaft—There should be no more than .004 inch clearance between the shaft and the bushings in which it operates.

There should be no more than .015 inch between the shifter fork and the groove in the gear in which it operates.

The shaft placed on lathe centers should run true within. 003 inch.

Inspection of Other Parts—The plunger spring should have a free length of one and one-half inches, and when compressed to one and one-eighth inches should support a load of 12 pounds.

Examine the locking plunger. It should be free from scores.

Replacement

In replacing, reverse operations under "Removal."

MAIN TRANSMISSION SHAFT AND MAIN TRANSMISSION SHAFT REAR BEARING

Removal

Remove the floor boards.

Remove the plug "Q," Fig. 39, and drain the transmission.

Remove the top cover plate. The plate is held in place by six cap screws.

Remove the shield over the forward universal joint. The shield is held in place by two small machine screws.

Remove the six bolts holding the front universal joint to the flange on the transmission shaft and remove the joint. Be careful in removing the bolts that the joint does not drop.

Remove the six cap screws directly back of the flange and remove the transmission drive shaft and bearing.

Remove the large cap screw which holds the flange to the shaft and remove the flange with a puller or by tapping it off.

Remove the felt washer, felt washer retainer, steel plate and gasket.

Remove the spacing collar and the oil throw-off ring.

The bearing can now be removed from the shaft by tapping it off.

Inspection

With gasoline or kerosene clean all parts removed.

INSPECTION OF SHAFT AND BALL BEARINGS—The main transmission shaft placed on lathe centers should run out of true no more than .0025 inch.

There should be no more than .004 inch clearance between the sides of the splines on the shaft and the sides of the spline ways in the shipper gears.

The large annular ball bearing should rotate smoothly and quietly and should have no more than .015 inch end play.

There should be no more than .004 inch shake between the front end of the main transmission shaft and the clutch connection when these parts are in place with the roller bearing.

INSPECTION OF OTHER PARTS—Inspect the roller bearing. It should be free from pits and chips.

Examine the teeth of the gears. These should show very little wear and be free from pits.

Examine the felt washer. If it is worn replace it. It should be well soaked in engine oil.

Inspect the forward universal joint. (See "Inspection" under "Universal Joints," page 124.)

Replacement

In replacing, reverse operations under "Removal."

TRANSMISSION

Removal

Remove the floor boards.

Disconnect the brake rods at the hand brake lever and at the brake pedal.

Remove the accelerator pedal. Then remove the accelerator shaft with arm, and disconnect at the engine the rod between the arm and the engine.

Remove the shield over the forward universal joint. The shield is held in place by two small screws.

Disconnect the universal joint from the flange on the transmission shaft. The joint is held to the flange by six bolts.

Remove the copper tube between the tire air compressor and the frame of the car.

Disconnect the clutch control rod from the lever at the bottom end of the rod, and remove the clutch pedal pull-back spring.

Remove the starter pedal.

Lift front end of car about twelve inches.

Remove the eight bolts holding the transmission to the crankcase. Remove the transmission by moving it straight back. Care must be exercised in removing the transmission not to drop it.

Disassembly

Remove the clutch. (See "Removal of Clutch" under "Clutch," page 112.)

Remove the drain plug "Q," Fig. 39, and drain the transmission.

Remove the tire air compressor. (See "Removal" under "Tire Air Compressor," page 113.)

Remove the clutch release shaft "Y." To remove the shaft proceed as follows: Remove the lever from the left-hand end of the shaft, also remove the Woodruff key.

Remove the two taper pins which hold the clutch release yoke to the shaft. The shaft may now be removed, tapping it out from the left side.

Remove the transmission top cover plate by removing the six cap screws.

Remove the transmission bottom cover plate.

Remove the shifter forks and shafts. (See "Removal" under "Shifter Forks and Shafts," page 120.)

Remove the reverse pinion. (See "Removal" under "Reverse Pinion," page 119.)

Remove the main transmission shaft. (See "Removal" under "Main Transmission Shaft and Main Transmission Shaft Rear Bearing," page 120.)

Remove the jackshaft with gears. (See "Removal" under "Jackshaft and Jackshaft Gears," page 117.)

Remove the clutch connection and the large annular ball bearing. (See "Removal" under "Clutch Connection and Clutch Connection Rear Bearing," page 115.)

Remove the mounting for the annular ball bearing. This may be removed by tapping it out.

Remove the hand brake lever ratchet.

Remove the hand hole cover "X."

Inspection

Inspect all parts removed in accordance with directions in this book.

Reassembly and Replacement

In reassembling and replacing the transmission, reverse operations under "Disassembly" and under "Removal."

Before replacing the transmission make sure that the annular ball bearing "D" is in good condition and well lubricated.

The forward end of the clutch connection shaft is milled off to receive the key in collar which fits into the annular ball bearing "D." In replacing the transmission, first make certain that the key in the collar and the key-way in the shaft, line up. This is very important. Care must be exercised in replacing the transmission not to damage the ball bearing or the clutch connection shaft.

UNIVERSAL JOINTS AND REAR AXLE

UNIVERSAL JOINTS

Removal of Forward Universal Joint

Remove the shield over the joint. The shield is held in place by two small machine screws

Remove the six bolts which hold the joint to the flange on the rear end of the transmission shaft. Care must be exercised not to allow the joint or shaft to drop.

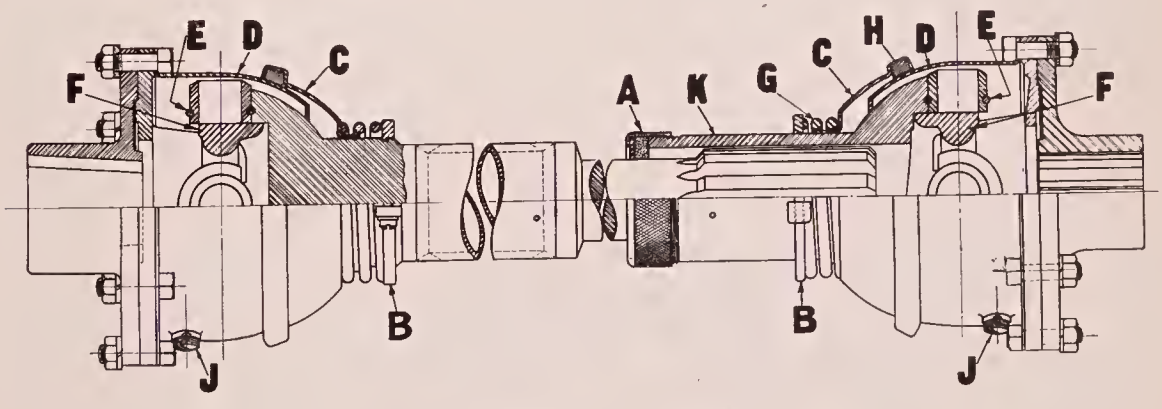


Fig. 40—Universal Joints and Drive Shaft.

Remove the collar "A," Fig. 40, by unscrewing it. The joint can now be removed.

Removal of Rear Universal Joint

Remove the six bolts holding the universal joint to the flange on the shaft of the axle. Care must be exercised not to allow the joint to drop.

The joint with drive shaft can now be removed by lowering it and pulling it back. Do not allow the forward end of the shaft to drop.

Disassembly of Universal Joints

Remove the joints as directed under headings "Removal of Forward Universal Joint," and "Removal of Rear Universal Joint," page 123.

Remove the clamps "B" and the shields "C" and "D."

Remove the locking rings "E" and tap out the bushings. The crosses can then be removed.

Inspection

Thoroughly clean all parts with kerosene or gasoline.

The drive shaft, placed between lathe centers, should run true within .020 inch.

There should be no more than .003 inch clearance between the sides of the splines of the drive shaft and the sides of the spline ways in the hub of the forward joint.

The clearance between the six bolts which attach each joint and the holes in the flanges should not exceed .002 inch.

There should be no more than .005 inch clearance between the arms of the crosses of the joints and the bushings in which they operate, and no more than .010 inch clearance between the sides of the yokes and the shoulders of the crosses.

Inspect the welded joints of the drive shaft.

Inspect the housings "C" and "D," also the packing washers "H."

Inspect the threads of the filler plugs "J" and the threads in the housings "D" into which they screw.

Replacement

In reassembling, have the "O" on the drive shaft and the "O" on the hub of the forward joint point directly toward each other. This will bring the yokes on the drive shaft ends in the same plane.

Make sure that the filling holes in the casings "D" do not come opposite the ends of the universal crosses, but directly between the ends. This will make it easier to fill the joints.

After replacing the joints refill each with eleven ounces of suitable lubricant. Cadillac Universal Joint Lubricant is recommended.

REAR AXLE

Removal

Block the front wheels and jack up the rear end of the frame at least six inches. Block up the frame securely.

Disconnect the four brake rods at the brake arms on the axle.

Disconnect the rear universal joint by removing the six bolts. Do not allow the joint to drop.

Disconnect the front end of the torque arm from the torque arm bolt, by removing the cotter pin and the nut at the bottom of the bolt. Do not allow the torque arm to drop.

Remove the nuts from the two spring clips at each side, and disconnect the rebound straps.

The axle complete with wheels can now be rolled from under the car.

Disassembly

Remove the wheels. (See "Removal of Rear Wheel and Bearings" under "Wheels," page 141.)

Remove the brake bands. (See under "Brakes," pages 125 and 126.)

Remove the differential complete with gear. (See "Removal" under "Differential and Large Driven Gear," page 126.)

Remove the driving pinion and pinion shaft. (See "Removal" under "Driving Pinion and Pinion Shaft," page 129.)

The adjusting collars "I" and "K," Fig. 15, may be removed after removing the large bolts across the top of the housing and taking out the locking plate.

Remove the long brake shafts. These may be pulled out after removing the cotter pins just back of the dust shields for the brakes and then loosening the clamp bolts on the brake arms.

Remove the torsion arm by taking out the torsion arm bolt. This bolt is held in place by a nut on one end and two clamps in the housing.

Remove the differential carrier from the housing. The carrier is held in place by sixteen nuts.

Remove the tie rod.

Remove the felt oil retainers in the housing. To do so, remove at least two of the three small cotter pins and remove the split retainer.

Inspection

Inspect all parts in accordance with directions in this book.

Reassembly and Replacement

In reassembling and replacing the axle, reverse operations under "Disassembly" and under "Removal."

BRAKES

Removal of External Brake Band

Remove the wheel. (See "Removal of Rear Wheel and Bearings" under "Wheels," page 141.)

Remove the brake pull rod and the pull back spring from the upper end of the lever "D," Fig. 16.

Remove the cotter pin, the adjusting nut "A" and the spring.

Remove the nut from the rear end of the bracket which acts as a stop for the two nuts "B."

Remove the nut "C" and the brake band.

Removal of Internal Brake Band

Remove the wheel. (See "Removal of Rear Wheel and Bearings" under "Wheels," page 141.)

Remove the cotter pins from the support just to the rear of the adjusting screws "R," Fig. 16.

Remove the cotter pin, the adjusting nut "J" and the spring.

Remove the pin "M" and remove the brake band.

Inspection

Inspect the brake band lining. The lining should be at least three thirty-seconds inch thick and not glazed. If it is glazed clean it up with gasoline and a stiff wire brush. Lining rivets should be tight and the heads should be beneath the surface of the lining. If it is necessary to reline a brake band follow directions under "Relining Brake Bands," page 49.

All brake pins should fit the shackles and levers within .005 inch.

Brake bands when in place, in correct adjustment and released, should be equally distant at all points from the brake drum. If not, the bands should be reshaped.

Replacement

After replacing the brake bands adjust them in accordance with directions in this book under "Brakes," page 46.

DIFFERENTIAL AND LARGE DRIVEN GEAR

Removal

It is unnecessary to remove the axle in order to take out the differential.

Remove the axle shafts by removing the hub caps and locking ring and pulling them out.

Remove the sixteen nuts which hold the rear cover plate "L" in place, Fig. 15, and remove the plate.

Remove the wires which lock the four large cap screws and loosen the screws. Unscrew the adjusting collars "T" and "N" one-half turn or more, then remove the four large cap screws and the bearing caps "O" and "R." Be careful not to drop the differential.

Remove the differential complete with driven gear.

Disassembly

To remove the large driven gear cut off the rivet heads, being careful not to spring the gear or flange of the differential housing, and tap out the rivets.

To disassemble the differential remove the twelve cap screws and separate the halves of the housing.

Inspection

With gasoline or kerosene thoroughly clean all parts.

INSPECTION OF DIFFERENTIAL AND DRIVEN GEAR—The flange of the differential housing should run true laterally and radially within .002 inch.

Examine the faces of the teeth of the driven gear, and of those of the six differential gears. They should show but little wear and should not be pitted. The teeth should not be chipped on the ends.

The hubs of the two large differential gears should have no more than .005 inch clearance in the hub of the cross. The end play in these two gears when the differential halves are bolted together should not exceed .008 inch.

The four small differential gears should have no more than .006 inch clearance on the arms of the cross and no more than .010 inch end play, when in place in the differential housing.

The ends of the cross should fit tightly into the differential housing.

INSPECTION OF OTHER PARTS—Examine the mountings, cones and rolls of the roller bearings. They should be smooth, free from pits and not chipped on the ends. The cages for the rolls should be in good condition.

With the bearing caps bolted in place the mounting for the roller bearings and the adjusting collars should be clamped.

Examine the faces of the pinion teeth. They should show but little wear and should be free from pits. The ends of the teeth should not be chipped.

Replacement

In replacing, reverse operations under "Removal."

After replacing differential adjust the bearings in accordance with directions in this book under "Adjustment of Gear and Pinion Bearings," page 42.

After replacing the rear cover plate and tightening the sixteen nuts, refill the housing with suitable lubricant. Cadillac Rear Axle and Transmission Lubricant is recommended. Five quarts are required.

REAR AXLE HOUSING

Removal

Remove and disassemble axle. (See "Removal and Disassembly" under "Rear Axle," pages 124 and 125.)

Inspection

With kerosene or gasoline clean all parts.

INSPECTION OF HOUSING—Draw a line through the axle having it pass through the centers of the axle ends at "A" and "B," Figs. 41 and 42. Dimensions "C" and "D," Fig. 41, taken from the line to the front and rear machined faces of the housing should vary by no more than one thirty-second inch. Dimensions "E" and "F," Fig. 42, taken

from the line to the centers of bolt holes "H" and "I" in the front face of the housing should vary by no more than one-thirty second inch.

The spring seats should have no more than .010 inch lateral play and no more than .006 inch radial play. The radial play can be taken up by reducing the edges of the caps with a mill file.

All rivets should be tight.

The threads on the ends of the housing should be in good condition.

INSPECTION OF OTHER PARTS—Inspect all parts removed in accordance with directions in this book.

Fig. 41—Rear Axle Housing, Top View.

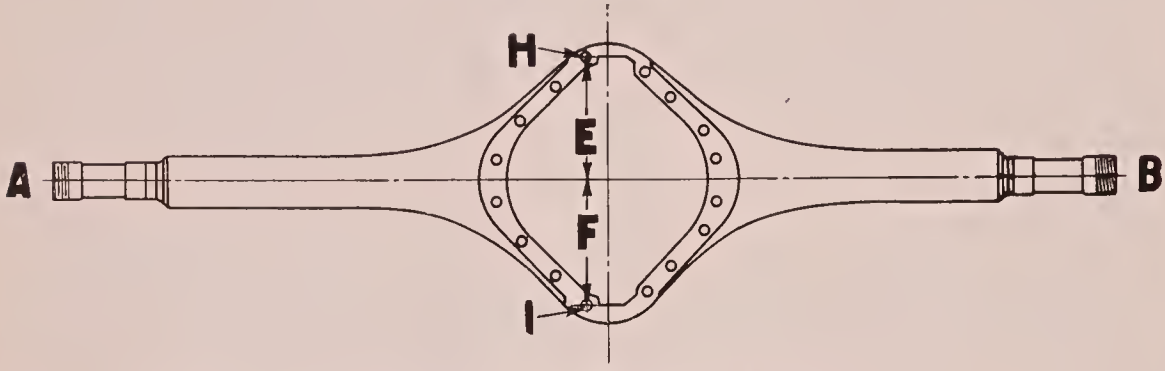


Fig. 42—Rear Axle Housing, Side View.

Reassembly and Replacement

After inspecting all parts reassemble and replace the axle. (See "Reassembly and Replacement" under "Axle," page 125.)

AXLE SHAFTS

Removal

Remove the oiler "A," Fig. 49, and remove the hub cap "B" by unscrewing.

Remove the locking ring "K."

Determine the amount of clearance between the drivers on the axle flange and the recesses which receive the drivers in the hub of the wheel. (See under "Inspection.")

Withdraw the axle shaft. If the axle shaft sticks it may be removed by tapping a cold chisel between the rear faces of the drivers on the axle flange and the bottoms of the recesses in the hub flange. If one of the axle shafts fits particularly tight, remove the looser one in accordance with these directions and drive out the other, by passing a bar of suitable size and length through the opposite end of the axle housing.

Inspection

There should be no more than .010 inch clearance between the drivers on the flange of the axle shaft and the recesses in the hub which receive the drivers.

The clearance between the splines of the axle shaft and the spline ways in the hub of the differential gears should not exceed .006 inch.

Placed on lathe centers the axle shaft should run out of true no more than .004 inch.

Replacement

The longer axle shaft goes on the right side.

After replacing the hub cap lock it with the oiler "A."

DRIVING PINION AND PINION SHAFT

Removal

It is unnecessary to remove the axle to remove the pinion and shaft.

Remove the differential complete with driven gear. (See "Removal" under "Differential and Large Driven Gear," page 126.)

Disconnect the rear universal joint by removing the six bolts. Do not allow the joint to drop.

Remove the nut which holds the flange to the axle shaft and remove the flange either with a puller or by tapping it off.

Remove the six small screws directly at the rear of the flange and remove the dust washer, packing, packing washer and spring.

Pull out through the rear of the housing the pinion with the shaft and the rear bearing. The front bearing may be removed through the front end of the housing.

The bearing mountings can be removed after loosening the two long clamping bolts across the top of the housing.

To remove the pinion from the shaft, first remove the cotter pin and the large nut on the end of the shaft, then remove the pinion from the shaft either with a press or by tapping it off.

Inspection

Clean all parts with kerosene or gasoline.

Inspection of Pinion and Shaft—Inspect the faces of the teeth of the pinion. They should show very little wear, and be free from pits. The teeth should not be chipped on the ends.

The shaft placed on lathe centers should run true within .002 inch.

The pinion should be tight on the end of the shaft.

Examine the threads on each end of the pinion shaft, also those in the nuts.

Inspection of Other Parts—Examine the bearing mountings, rolls and cones. These parts should be smooth and free from pits and not chipped. The bearing cages should be in good condition.

The cone of the rear bearing should have no more than .002 inch clearance on the hub of the pinion. The cone of the forward bearing should have no more than .002 inch clearance on the shaft.

With the bolts across the top of the housing tightened, the bearing mountings and the adjusting collars should be clamped in the housing.

Examine the faces of the teeth of the driven gear. They should show but little wear and should be free from pits. The ends of the teeth should not be chipped.

Replacement

In replacing the pinion and pinion shaft, reverse operations under "Removal." In replacing the bearings, the driven gear and the driving pinion, make adjustments in accordance with directions in this book under "Rear Axle," page 42.

Refill the axle with suitable lubricant. Cadillac Rear Axle and Transmission Lubricant is recommended. Five quarts are required.

FRONT AXLE AND STEERING GEAR

STEERING ARMS

Removal

Remove the nut "P," Fig. 47, from the parallel rod bolt.

In removing the left steering arm, next disconnect the steering connecting rod from the arm. (See "Disconnecting Front End" under "Steering Connecting Rod," page 139.)

Remove the cotter pin and the large nut from the rear end of the arm and drive out the arm.

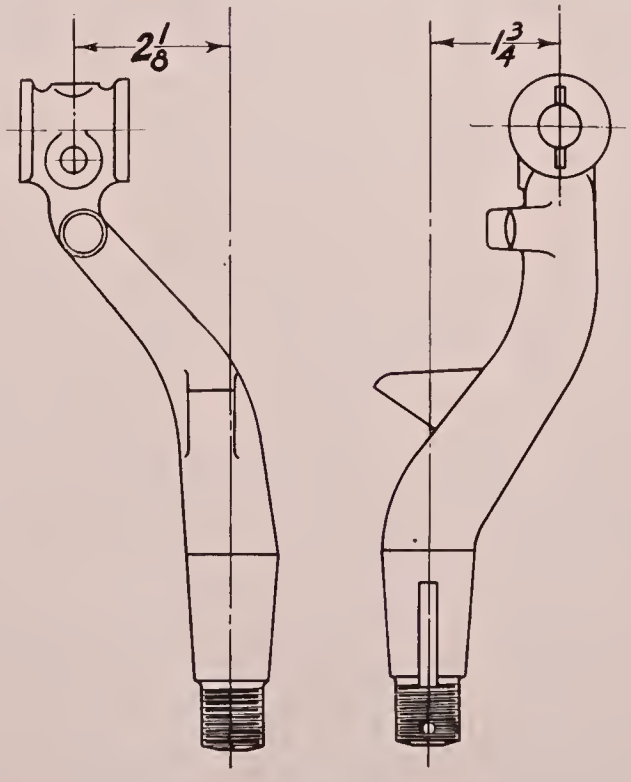


Fig. 43—Right Spindle Arm.

Inspection

INSPECTION OF ARM—Examine the threads on the steering arm, also the threads in the large nut.

Determine if the arm is bent or sprung. (See Figs. 43 and 44.)

Examine the forging carefully.

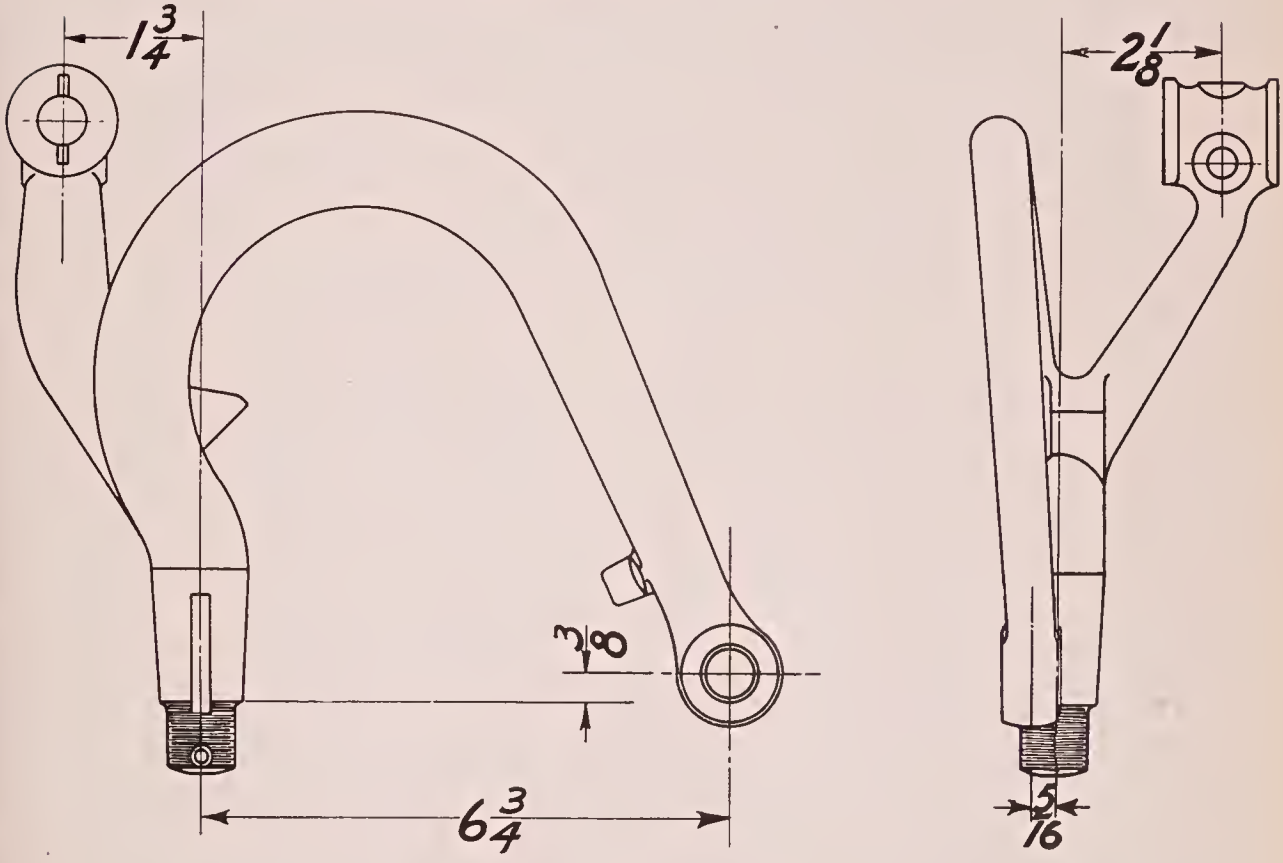


Fig. 44—Left Spindle Arm.

INSPECTION OF OTHER PARTS—There should be no more than .005 inch clearance between the bushings in the parallel rod yoke and the bolt. If it is necessary to remove one of these bushings, do so with a press or drive it out, and press or drive in the new one.

If the left-hand steering spindle is removed examine the pivot on the arm. It should be round within .010 inch.

Examine the threads in the end of the steering connecting rod, also the threads on the adjusting screw and the surfaces of the bronze bearings.

Replacement

In adjusting the screw at the front end of the steering connecting rod do not take it up too tightly. Tighten it only sufficiently to take up all shake.

Do not tighten the nut "P," Fig. 47, sufficiently to bind the yoke on the steering arm.

FRONT AXLE

Removal

Jack up the front end of the car until the front wheels are free from the ground.

Remove the front wheels. (See "Removal of Front Wheel and Bearings" under "Wheels," page 140.)

Disconnect the speedometer cable at the spindle.

Disconnect the front end of the steering connecting rod. (See "Disconnecting Front End" under "Steering Connecting Rod," page 140.)

Remove the nuts on the four spring clips which hold the axle to the spring and remove the spring clips and axle complete with spindles.

Disassembly

Remove the grease cups from the spindles and steering arms.

Remove the parallel rod. (See "Removal" under "Parallel Rod," page 133.)

Remove the spindles with steering arms. (See "Removal" under "Front Axle Spindles," page 134.)

Remove the roller bearing mountings in the upper ends of the axle yokes and the plain bearings at the lower ends of the axle yokes by tapping them out.

Inspection

Lines "C" and "D," Fig. 45, drawn through the centers of the bores in the axle yokes from which the bearing mountings and bearing bushings were removed, should be in the same plane and parallel.

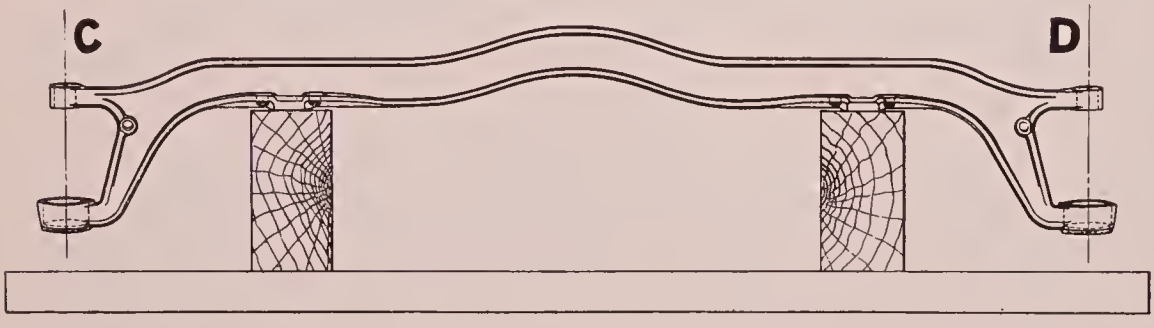


Fig. 45—Inverted Front Axle, Side View.

The center line of the bores in the yokes should incline one-eighth inch from the upper face of the upper yoke to the lower face of the lower yoke. This may be tested by placing the axle upside down upon parallel bars as shown in Figs. 45 and 46, and with a square as shown in Fig. 46, taking dimensions "A" and "B." These dimensions should differ by approximately one-eighth inch.

The mountings at the upper ends of the yokes, and the bushings in the lower ends of the yokes should be a press fit into the axle.

The mountings, cones and rolls of the roller bearings should be smooth, free from pits and not chipped. The cages should be in good condition.

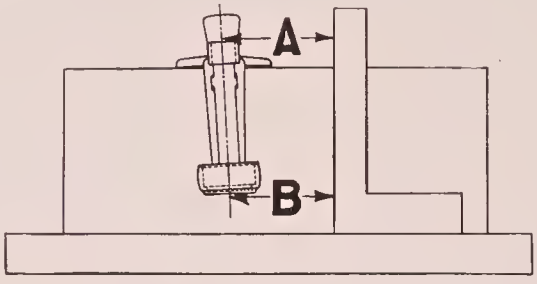


Fig. 46—Inverted Front Axle, End View.

There should be no more than .005 inch clearance between the spindle bolt and the bushing at the lower end of the axle yoke.

Inspect the spindles. (See "Inspection of Spindle" under "Front Axle Spindles," page 135.)

Replacement

In replacing the spindle bolts adjust the nuts at the lower ends in accordance with directions under "Adjustment of Spindle Bearing," page 49.

Adjust the front wheel bearings in accordance with directions under "Adjusting Front Wheel Bearings," page 51.

In adjusting the nut at the front end of the steering connecting rod do not adjust it too tightly. Tighten it only sufficiently to take up all shake.

Adjust the spindle arm stop screws "H," Fig. 47, in accordance with directions under "Spindle Arm Stop Screws," page 49.

PARALLEL ROD

Removal

Remove the nut "P," Fig. 47, at each end of the parallel rod.

Remove the taper pins which prevent the parallel rod bolts from turning and tap out the bolts, being careful not to damage the threads.

Inspection

INSPECTION OF PARALLEL ROD—Examine the rod. It should be straight and free from dents. The threads on the ends of the rod and in the rod yokes should be in good condition.

There should be no more than .005 inch clearance between the bushings in the yokes and the bolts. If it is necessary to replace

one of the bushings remove it with a press, or by driving it out, and press, or carefully drive in, the new bushing.

INSPECTION OF OTHER PARTS—Examine the bearing surfaces of the spindle bolts, also the threads on the ends of the bolts and the threads in the nuts.

Replacement

In replacing the yokes on the rod have the threaded ends at each end extend an equal amount into the yokes.

After replacing the rod, align the front wheels in accordance with directions in this book under "Alignment of Front Wheels," page 52. Do not re-align the front wheels by adjusting one yoke only. Adjust both yokes so that the parallel rod will extend into each yoke an equal amount after the work is completed. Be sure that the parallel rod extends into each yoke at least one inch.

Do not tighten the nuts "P" sufficiently to bind the yokes on the steering arm.

FRONT AXLE SPINDLES

Removal

Jack up the axle and remove the wheel. (See "Removal of Front Wheel and Bearings" under "Wheels," page 140.)

Remove the nut "P," Fig. 47, from the parallel rod bolt.

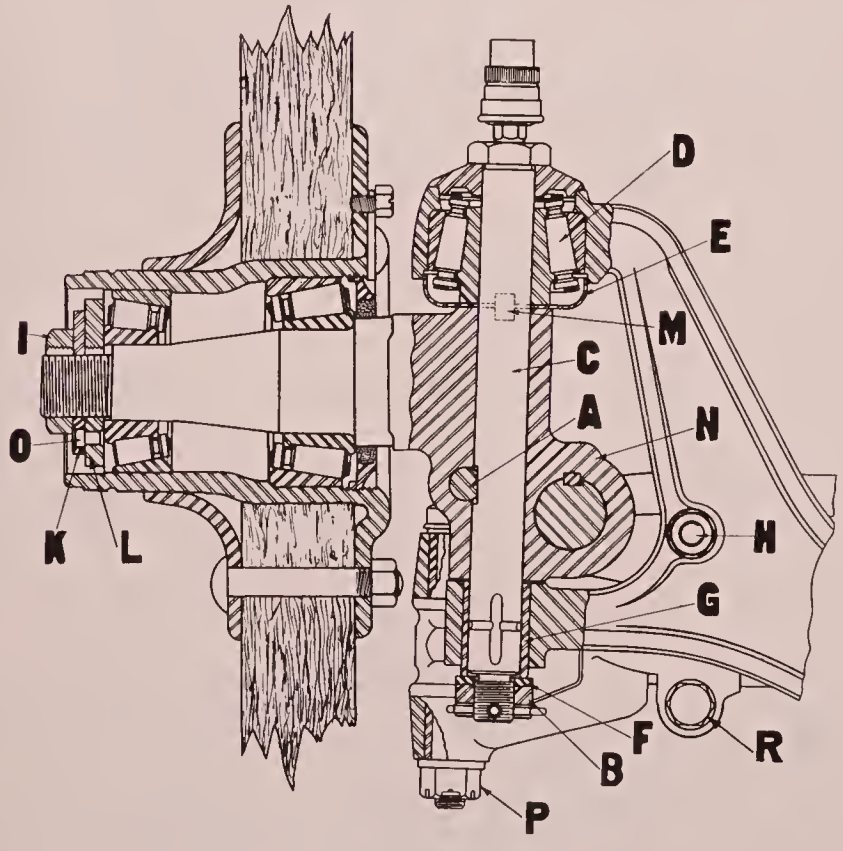


Fig. 47—Left Front Spindle.

Remove the taper pin which prevents the parallel rod bolt from turning and tap out the bolt, being careful not to damage the threads.

If removing a left spindle, next disconnect the steering connecting rod from the steering arm. (See "Disconnecting Front End" under "Steering Connecting Rod," page 140.)

Remove the nut "B."

Remove the taper pin "A."

Drive out the spindle bolt "C," being careful not to injure the threads.

Remove the spindle.

To remove the steering arm, first remove the large nut, then either press or drive it out, being careful not to injure the threads.

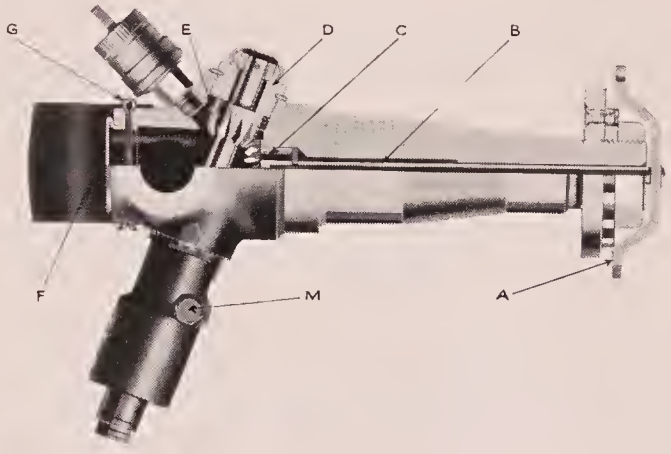


Fig. 48—Right Front Spindle, Sectional View.

Remove the speedometer gears in the right hand spindle by unscrewing the nut "D," Fig. 48, pulling out the cotter pin "G" and removing the cap "F."

Inspection

With kerosene or gasoline clean all parts removed.

INSPECTION OF SPINDLE—Placed on lathe centers, that part of the spindle which receives the wheel bearings should run true within .002 inch.

There should be no more than .002 inch clearance between the cones of the roller bearings and the spindle.

The threads on the spindle should be in good condition.

INSPECTION OF OTHER PARTS—Inspect the roller bearings. The cones, rolls and mountings should be smooth and free from pits and chips. The roller cage should be in good condition.

There should be no more than .005 inch clearance between the lower end of the spindle bolt and the bushing in the axle yoke.

The threads on the lower end of the spindle bolt in the nut and in the front wheel adjusting nut and lock nut must be in good condition.

Inspect the spindle arm. (See "Inspection of Arm" under "Steering Arms," page 131.)

Replacement

In replacing, reverse operations under "Removal."

In adjusting the nut at the front end of the steering connecting rod, do not adjust it too tightly. Tighten it only sufficiently to take up all shake.

In adjusting front wheel bearings follow directions in this book under "Adjusting Front Wheel Bearings," page 51.

In replacing the nut "B" make the adjustment in accordance with directions in this book under "Adjustment of Spindle Bearing," page 49.

Adjust the spindle arm stop screws "H," Fig. 47, in accordance with directions under "Spindle Arm Stop Screws," page 49.

STEERING GEAR

Removal—(Body on Car)

Remove the splash pan under the engine.

Remove the steering arm "F," Fig. 19, from the sector shaft. The end of the sector shaft and the hole in the steering arm are tapered and serrated, the parts being held together by a large nut locked with a spring washer. After removing the nut and lock washer, remove the arm with a puller.

Remove the cap screw "C" and the wrench "D," and pull out the long eccentric adjusting bushing.

Remove the two one-eighth inch control rods between the steering gear and engine.

Remove the cover plate on the rear face of the steering gear housing. This plate is held in place by five five-sixteenth inch cap screws.

Push in the sector shaft until its outer end is just beyond the inner face of the frame.

Disconnect at the horn the wire running from the steering gear to the horn and remove the connector from the end of the wire by unsoldering it.

*Remove the small bronze segment gears from the lower ends of the spark and throttle control tubes. These gears are clamped to the tubes by one-quarter inch cap screws.

*Lay back the top and pull out the spark and throttle tubes complete with the sector upon which they operate and the tube to which the sector is attached. The sector tube is clamped in place at the lower end by a five-sixteenths inch cap screw in the housing support bracket which is bolted to the lower end of the steering gear housing.

*Remove the nut which holds the steering wheel in place and with a puller tool number 56479, furnished by the Cadillac Motor Car Company, remove the wheel. Then remove the key.

*Disconnect the steering gear bracket from the instrument board.

Remove the rod between the carburetor and the arm on the steering gear.

Remove the support for the headlight control tube and rods.

Remove the four three-eighths inch bolts which hold the steering gear housing to the frame.

Raise the front end of the car about six inches and remove the steering gear by passing it down between the crankcase of the engine and the frame of the car.

Removal—(Body off Car)

*To remove the steering gear with the body off the car, omit operations preceded by asterisks.

Disassembly

It is necessary to partly disassemble the steering gear before removing it, provided the engine or body are in place. With the steering gear removed in accordance with directions under "Removal (Body on Car)," proceed as follows in completing the disassembly.

Remove the steering sector.

Remove the support bracket at the lower end of the steering gear housing. The bracket is held to the steering gear housing by four three-eighths inch cap screws. In removing the bracket do not allow the thrust bearing to drop.

Through the lower end of the housing remove the steering tube with worm, upper thrust bearing for the worm and the spring, washer and cone of the bearing at the upper end of the housing tube.

Loosen the clamping screw at the upper end of the steering gear housing and remove the housing tube. If the tube does not pull out easily, open the clamp by carefully tapping in a small chisel. Open the jaws of the clamp only sufficiently to make possible the removal of the tube.

Remove the set screws "A," Fig. 19, and the collar "L," Fig. 18, by unscrewing.

Inspection

Inspect the teeth of the worm and sector. They should show very little wear and be free from scores.

There should be no more than .004 inch clearance between the sector shaft and the eccentric bushing in which it has its bearing. The eccentric bushing should be a snug sliding fit in the housing and free from scores.

There should be no more than .004 inch clearance between the hubs of the steering worm and the bearings which receive them.

Inspect the balls and races of the thrust bearings. They should be free from pits and in good condition.

Examine the serrations on the end of the sector shaft and in the steering arm, also the threads on the end of the sector shaft.

The adjusting spring at the upper end of the steering tube should have a minimum free length of three inches. The cone and cup of the bearing should be in good condition. The cone should move freely on the steering tube.

The plunger springs in the spark and throttle levers should have a free length of thirteen-sixteenths inch and have sufficient tension to hold the levers where set.

The serrations at the bottom ends of the spark and throttle tubes and in the segment gears should be in good condition.

Inspect the housing, also all machined surfaces of the housing.

Reassembly and Replacement

In reassembling and replacing steering gear, reverse operations under "Removal and Disassembly."

Adjust the thrust bearings for the worm in accordance with directions under "Adjustment of Worm Thrust Bearings," page 49.

In replacing the sector have the hinge of the steering wheel ahead, then mesh the teeth of the worm and sector so that four teeth are out of mesh on each end of the sector. If none of the steering arms or shafts have become bent and the worm and sector teeth are properly meshed, the front wheels should be approximately straight ahead when the hinge of the steering wheel is directly forward.

In replacing the long eccentric adjusting bushing have the thick side of the bushing face in the direction of the worm of the steering gear, and make certain that the tongues on the inner end of the bushing enter the tongue ways in the thrust ring. Before putting the wrench "D", Fig. 19, onto the outer end of the bushing, rotate the bushing in a counter-clockwise direction until the correct adjustment between the worm and sector is made. (See under "Adjustment of Worm and Sector," page 50.)

In replacing the small segment gears on the lower ends of the spark and throttle tubes, so mesh the teeth with the teeth of the larger segment gears, that the end teeth of the smaller gears do not pass the ends of the larger gears in moving the spark or throttle levers from the extreme left to the extreme right, or vice versa.

The adjustment of the control rods should be checked. The throttle in the carburetor should be permitted to "close" but should

start to open immediately the throttle lever on the steering post is moved from the extreme left position.

The lever on the distributor and timer should be permitted to reach the fully retarded position but should move immediately the spark lever is moved from the left position.

After completing this work it is a good plan to recheck the ignition timing. (See under "Timing Ignition," page 23.)

Refill the steering gear housing with suitable lubricant. Cadillac Steering Gear Lubricant is recommended.

In readjusting the rod which runs from the hand lever on the steering gear to the carburetor, have its forward end stand in the center of the slot in the lever "S," Fig. 36, when the auxiliary air valve lever on the steering post is all the way down.

If the adjustment of screw "H," Fig. 18, has been changed, it should be readjusted in accordance with directions in this book under "Adjustment of Worm and Sector." Make sure that the cap screws in cover plate are tight before making this adjustment.

In replacing the nut which holds the steering arm to the sector shaft, be sure that it is well tightened.

HOUSING FOR STEERING GEAR WORM AND SECTOR

Removal

Remove and disassemble the steering gear. (See "Disassembly" under "Steering Gear," page 137.)

Inspection

With kerosene or gasoline clean all parts removed.

INSPECTION OF HOUSING—Inspect the housing carefully.

The long eccentric bushing should be a sliding fit in the housing.

INSPECTION OF OTHER PARTS—Inspect all parts in accordance with directions in this book.

Reassembly and Replacement of Steering Gear

After inspecting all parts in accordance with directions in this book, reassemble the steering gear and replace it. (See "Reassembly and Replacement" under "Steering Gear," page 138).

STEERING CONNECTING ROD

Disconnecting Rear End

Remove the grease cup.

Remove the leather boot.

Remove the cotter pin, adjusting screw and spring.

The rear end of the rod can now be removed from the pivot on the steering arm.

To remove the rear pivot bearing, screw into it a one-fourth inch rod threaded on the end with number 20 thread.

Disconnecting Front End

Remove the grease cup.

Remove the leather boot.

Remove the cotter pin and adjusting screw.

The front end of the rod can now be removed from the pivot on the steering arm.

Inspection

With gasoline or kerosene clean all parts removed.

Inspection of Steering Connecting Rod—Examine the rod. It should be true and free from dents.

Examine the welds at each end of the rod.

The thread in each end should be in good condition.

Inspect the adjusting screws. The threads should be in good condition.

Examine the bronze bearings. All machined surfaces should be in good condition.

The springs should have a free length of approximately five-eighths inch.

Inspection of Other Parts—Examine the pivots on the steering arms. These should be in good condition and out of round no more than .010 inch.

Replacement

In replacing pack the bearings with cup grease. Cadillac Cup Grease is recommended.

Take up the adjustment just enough to take up all play in the bearings, but not sufficiently to bind the bearings on the pivots. If the adjusting screws are too tightly drawn up, excessive wear on the pivots and bearings, and stiff steering will result.

Do not replace the used cotter pins. Use new ones.

WHEELS

Before starting to remove a wheel, jack up the axle, turn the wheel slowly and determine if it is out of true. A wheel should run out of true no more than five thirty-seconds inch. Do not make this test either on the tire, or on the demountable rim, but on the felloe band of the wheel.

Removal of Front Wheel and Bearings

Jack up the axle until the wheel is free from the ground.

Remove the hub cap by unscrewing it.

Remove the locking nut "I," Fig. 47, (left-hand thread on left-hand spindle).

Remove the washer "K."

Remove the adjusting nut "L," (left-hand thread on left-hand spindle).

Remove the wheel, being careful not to drop the outer roller bearing.

The inner roller bearing can be removed, after removing the retainer. The inner and outer mountings can be removed by driving them out.

In removing the right-hand wheel, pull out the speedometer drive shaft "A," Fig. 48, after removing the hub cap.

Removal of Rear Wheel and Bearings

Remove the lubricator "A," Fig. 49, and remove the hub cap by unscrewing it.

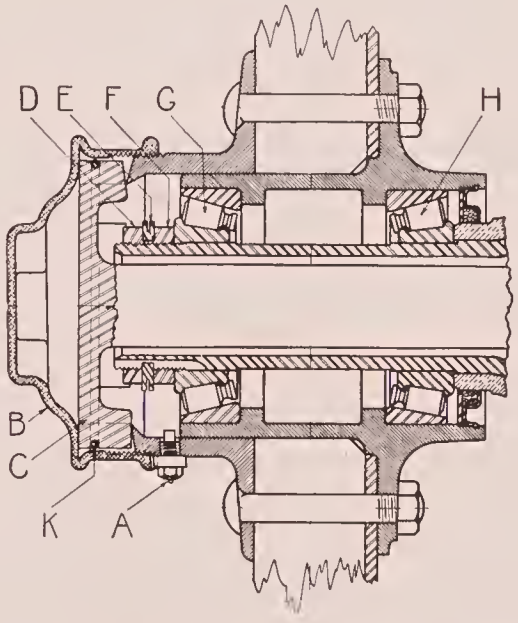


Fig. 49—Rear Wheel Bearings and Adjusting Nuts.

Remove the locking ring "K" and withdraw the axle shaft. If the axle shaft sticks it may be removed by tapping a cold chisel between the rear faces of the drivers on the axle flange and the bottoms of the recesses in the hub flange. If one of the axle shafts fits particularly tight, remove the looser one in accordance with these directions and drive out the other, by passing a bar of suitable size and length through the opposite end of the axle housing.

Jack up the axle until the wheel is free from the ground and remove the lock nut "D," the washer "E," and the adjusting nut "F."

Remove the wheel, being careful not to drop the outer bearing. The removal of the wheel is facilitated if it is removed squarely.

The inner bearing may be removed after removing the retainer. The inner and outer mountings can be removed by driving them out.

Inspection

INSPECTION OF WHEEL—The wood parts should be free from cracks and fitted together tightly.

The nuts on all hub and brake drum bolts should be tight. The ends of the bolts should be headed over slightly to prevent the nuts loosening.

Bearing mountings should be a driving fit into the wheel hubs.

Wheels at the felloe band should run true within five thirty-seconds inch laterally.

The brake drums on the rear wheels should run true within one-sixteenth inch radially.

INSPECTION OF OTHER PARTS—Examine the bearing surfaces of the mountings, cones and rolls. The surfaces should be smooth and free from pits and chips. The roller cages should be in good condition.

The bearing cone should have no more than .002 inch clearance on the spindles of the axle.

The bolts for the rim wedges should be straight. The threads on the bolts and in the wedges should be in good condition.

Inspect the demountable rims. Demountable rims should be free from dents or other injuries, and when off the wheel should be round within one-eighth inch. The locking ring, the lock, and the rivet which holds the lock to the rim, should be in good condition. When off the rim, the ends of the locking rim should point directly toward each other and come together.

Replacement

Before replacing the bearings, fill between the rolls with suitable lubricant. Approximately three ounces are required for each wheel. Cadillac Wheel Bearing Grease is recommended.

Adjust the bearings in accordance with directions in this book under "Adjusting Front Wheel Bearings," page 51.

FRAME AND SPRINGS

FRAME

Removal

Remove the tire carrier and the tail lamp.

Remove the body complete with top and windshield. (See "Removal" under "Body," page 146.)

Remove the front fenders. (See "Removal of Front Fender" under "Fenders," page 147.)

Remove the running boards and dust shields. (See under "Running Boards and Dust Shields," page 146.)

Remove the radiator. (See "Removal" under "Radiator," page 103.)

Remove the dust shield over the forward universal joint, and disconnect the joint from the drive shaft on the transmission. Do not allow the joint to drop.

Disconnect the brake rods from the brake pedal and the hand brake levers.

Remove the pull-back spring between the clutch pedal and the frame and remove the copper pipe between the tire air compressor and the frame.

Remove the engine in accordance with directions under "Engine," page 66, but do not disconnect the transmission from the engine.

Remove the front axle by first removing the four spring clips, then disconnecting the steering connecting rod at the front end.

Remove the rear axle. (See "Removal" under "Rear Axle," page 124.)

Remove the three rear springs by removing the spring bolts at the front ends of the side springs and the two spring clips at the center of the cross spring.

Remove the front springs by removing the bolts at the front ends of the springs and those at the upper ends of the shackles at the rear ends.

Remove the gasoline tank by disconnecting the unions on the two pipes to the tank and removing the three nuts. In removing the washers under the two forward nuts observe the manner in which they are assembled. These washers must be put back as originally assembled.

Remove the piping from the frame.

Remove the brake cross shafts.

Remove the steering gear by first removing the steering arm and then removing the four three-eighth inch bolts.

Inspection

Determine if the frame has become bent or sprung. To do so take the following dimensions:

From the machined face of bracket "C," Fig. 50, to the machined face of bracket "D" should be from 25⅞ inches to 26 inches.

Dimensions "A" and "B" taken from the center of the socket "E" to the centers of the large bolt holes in the brackets "C" and "D" should vary by no more than .020 inch.

Pass a center line through the center of the bracket "E" and through a point equally distant from the machined faces of the bracket "C" and "D." Dimensions "F" and "J," taken from the line to the centers of brackets "H" and "I," should vary by no more than .060 inch. Dimensions "O" and "P" taken from the centers of the taper holes in brackets

"M" and "N" should vary by no more than .100 inch. Dimensions "R" and "S" taken from the centers of brackets "K" and "L" should vary by no more than .025 inch.

To determine if the frame side bars are parallel, lay parallel bars across the frame directly over the front engine support and over brackets "H" and "I." By sighting across these bars it may be determined if the frame is twisted.

Examine all rivets. They should be tight in the frame.

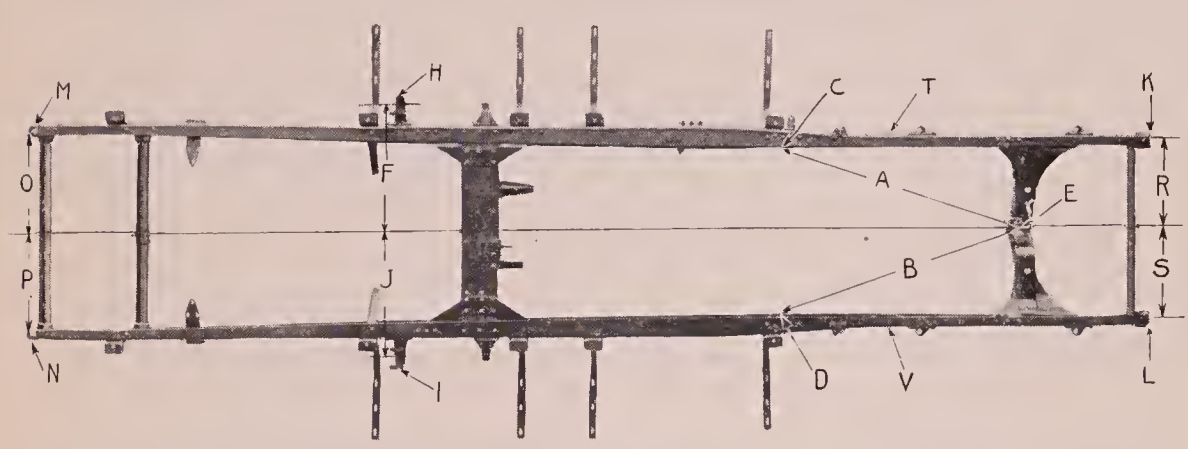


Fig. 50—Frame.

Examine the machined surfaces of socket "E," also the threads for the socket cap screws.

Inspect the bronze bushings "T" and "V." There should be no more than .004 inch clearance between these bushings and the bolts. The bushings should be a tight driving fit into the frame brackets.

The clearance between the sides of the brackets "K," "L," "I" and "H" and the spring ends with the washers in place should not exceed .004 inch. Washers of different thicknesses are provided to take up play at these points.

Examine the bushings in which the brake shafts operate. There should be no more than .004 inch clearance between a brake shaft and brake shaft bearing.

Examine the tubular cross members. They should be straight and tight in the brackets at each end.

Replacement

In replacing, reverse operations under "Removal."

All spring bolts, brake shafts, etc., should be well lubricated before they are replaced.

Do not tighten spring bolts sufficiently to bind the spring ends. After tightening the large bolts which hold the rear engine supports to the frame, loosen the nuts one notch before putting in the cotter pins.

SPRINGS

Removal of Front Spring

Jack up the front end of the car approximately four inches.

Remove the nuts from the two spring clips.

Remove the bolts at each end of the spring and remove the spring.

Removal of Rear Side Spring

Jack up the rear end of the car approximately four inches.

Remove the nuts from the two spring clips.

Remove the bolt at each end of the spring and remove the spring.

A small door is provided in each dust shield to facilitate the removal of the forward bolts.

Removal of Cross Spring

Jack up the rear end of the car approximately five inches.

Remove the nuts from the two spring clips.

Remove the bolts at each end of the spring and remove the spring.

Disassembly

Remove the bolt in the center of the spring and the bolts in the clips which enclose a portion of the leaves. These bolts are headed over on the ends. File the ends off flush with the nuts and remove the nuts. Use new bolts in reassembling springs.

Inspection

Examine the spring leaves; they should be unbroken, free from cracks and smooth where they contact with other leaves. If they are not smooth, clean them up.

Examine the bronze bushings in the eyes of the longest leaf. The bushings should be a tight driving fit into the spring eyes and have no more than .004 inch clearance on the spring bolts.

Replacement

All rust should be cleaned from the surfaces of the leaves, which contact with other leaves, and the surfaces should be well lubricated with suitable lubricant before the spring is reassembled. Graphite grease is recommended.

Care must be exercised in drawing up the spring shackle bolts not to bind the spring ends in the shackles.

If there is more than .004 inch clearance between the front ends of the rear and front side springs and the brackets, replace the washers by thicker ones.

All spring clips should be well tightened.

BODY, RUNNING BOARDS AND SHEET METAL PARTS

BODY

Removal

Remove the tire carrier.

Remove the rear fenders. (See "Removal of Rear Fender" under "Fenders," page 148.)

Remove the floor boards.

Disconnect the steering gear bracket from the instrument board.

Remove the tie rod between the body and the radiator.

Disconnect the three small nickel plated copper pipes at the dash by unscrewing the unions and removing the four clips which support them.

Remove the speedometer cable.

Disconnect from the storage battery the large cable, and block it up with a dry piece of wood to prevent it touching the terminal of the battery. Remove the generator top cover plate and remove from the generator the four small wires.

Disconnect from the front face of the dash the flexible tube which runs to the right-hand high tension conduit. Disconnect the low tension and high tension wires from the coil and remove these wires through the hole in the dash.

Disconnect the two headlight wires from the body. Connectors are provided at the front end of the body on each side.

Remove the rod between the lever on the steering post and the carburetor.

Remove the nuts which hold the body to the frame and remove the body.

Replacement

Before replacing body make sure that the "anti-squeak" material is in good condition. All body bolts should be drawn down firmly.

Before replacing the wires to the generator, or to the coil or the cable to the storage battery, make sure that the terminals are clean. All terminals should be well tightened.

In setting on the body, care must be exercised not to allow it to strike the steering wheel.

RUNNING BOARDS AND DUST SHIELDS

Removal of Right Running Board and Dust Shield

Remove the two cap screws which hold the rear fender to the running board and the three bolts which hold the fender to the dust shield.

Remove the front fender. (See "Removal of Front Fender" under "Fenders," page 147.)

Remove the nut which holds the dust shield bracket to the frame of the car. This bracket is between the dust shield and the frame, approximately midway between the fenders.

Remove the nine nuts which hold the running board to the running board brackets and the six nuts which hold the dust shield to the running board.

Remove the running board.

Loosen the forward body bolts and remove the dust shield.

Removal of Left Running Board and Dust Shield

Remove the two cap screws which hold the rear fender to the running board and the three bolts which hold the fender to the dust shield.

Remove the front fender. (See "Removal of Front Fender" under "Fenders," on this page.)

Remove the storage battery. This may be done after the two cables are removed, also the nuts on the two long hold-down bolts. Care must be exercised in removing the battery not to drop it or to spill the contents.

Remove the four bolts which hold the dust shield to the frame. The four nuts are directly back of the storage battery.

Disconnect at the dust shield, the terminal on the end of the tube from the tire air compressor.

Remove the nine nuts which hold the running board to the running board brackets and the five nuts which hold the dust shield to the running board.

Remove the running board.

Remove the horn and pull the horn wires through the dust shield.

Loosen the forward body bolts and remove the dust shield.

Inspection

Examine the dust shields for cracks and dents.

The running board should be free from cracks and should not be warped.

Examine the threads on the running board hold-down bolts and nuts.

Replacement

In replacing the dust shield make sure that the "anti-squeak" material between the fenders and shield is in good condition.

All bolts and nuts should be well tightened.

FENDERS

Removal of Front Fender

Remove the hood.

Remove the head lamp with the bracket.

Remove the two hood pulls. Each hood pull is held in place by two small machine screws.

Remove the hood shelf. The hood shelf is held in place by four bolts.

Disconnect, at the body, the wires to the head lamp. The connector is at the forward end of the body.

Remove the two cap screws which hold the fender to the running board.

Remove the seven small machine screws which hold the fender to the dust shield.

Remove the two large nuts which hold the fender support arms to the fender brackets on the frame, and remove the fender.

Removal of Rear Fender

Remove the two cap screws which hold the fender to the running board.

Remove the six small bolts which hold the fender to the dust shield.

Remove the cap screws which hold the fender to the body and remove the fender.

Inspection

Examine the fenders for cracks and dents.

Replacement

Make sure that the "anti-squeak" material between the front fender and the frame, between the rear fender and the body and between the front and rear fenders and dust shield is put back as originally assembled, or replaced by new if not in good condition.

PART III
LUBRICATION

LUBRICANTS

There are many grades of oils. There are none too good. Naturally, we have experimented a great deal with numerous lubricants to determine which are best adapted for the various parts of the Cadillac car. It is not always an easy matter to obtain suitable lubricants. The constant demand made upon us has induced us to provide suitable lubricants.

Cadillac Motor Oil

Cadillac Motor Oil is recommended and may be used for summer and winter. In the absence of Cadillac Motor Oil we recommend lubricant of the following specifications:

Gravity not lower than 26½ Baume at 60 degrees Fahrenheit. Flash test not below 400. Fire test not below 460. Viscosity not less than 220 at 70 degrees Fahrenheit. The oil should be a filtered one, not an acid, or alkali treated oil.

The cold test of the oil should be such that it will circulate in the engine at a temperature of from 15 degrees to 20 degrees Fahrenheit below zero. The laboratory cold test should be zero Fahrenheit or below.

The oil should be refined from Pennsylvania Crude, or its equivalent.

Mobiloil A, Monogram Medium, or Amalie Non-Carbon Oil can be used in summer, and Mobiloil Arctic in winter.

Engine oil should be strained through cheese cloth or fine mesh wire cloth before using.

Cadillac Rear Axle and Transmission Lubricant

Cadillac Rear Axle and Transmission Lubricant is recommended for the rear axle and transmission. In its absence we recommend a mixture of steam cylinder oil and a small amount of cup grease mixed to such a consistency that the mixture flows easily at temperatures from sixty degrees to seventy degrees Fahrenheit.

Cadillac Cup Grease

Cadillac Cup Grease is recommended for use in the grease cups. In its absence, number three cup grease is recommended.

Cadillac Wheel Bearing Grease

Cadillac Wheel Bearing Grease is recommended for the wheel bearings. In its absence, number one cup grease is recommended.

Cadillac Universal Joint Grease

Cadillac Universal Joint Grease is recommended for the universal joints on the drive shaft. In its absence, number three fibre grease is recommended.

Cadillac Steering Gear Grease

Cadillac Steering Gear Grease is recommended for the steering gear. In its absence, a mixture consisting of seventy-five per cent 600 W. lubricant, and twenty-five per cent number one cup grease is recommended.

ENGINE LUBRICATION

Lubricating System

The lubrication of Cadillac eight-cylinder engines is by oil under pressure. A supply of oil is carried in the oil pan "A," Fig. 51. Oil is drawn from the oil pan by the oil pump "C" through the pipe "B" and forced to the main bearings "E," "F" and "G," through the supply pipe "D."

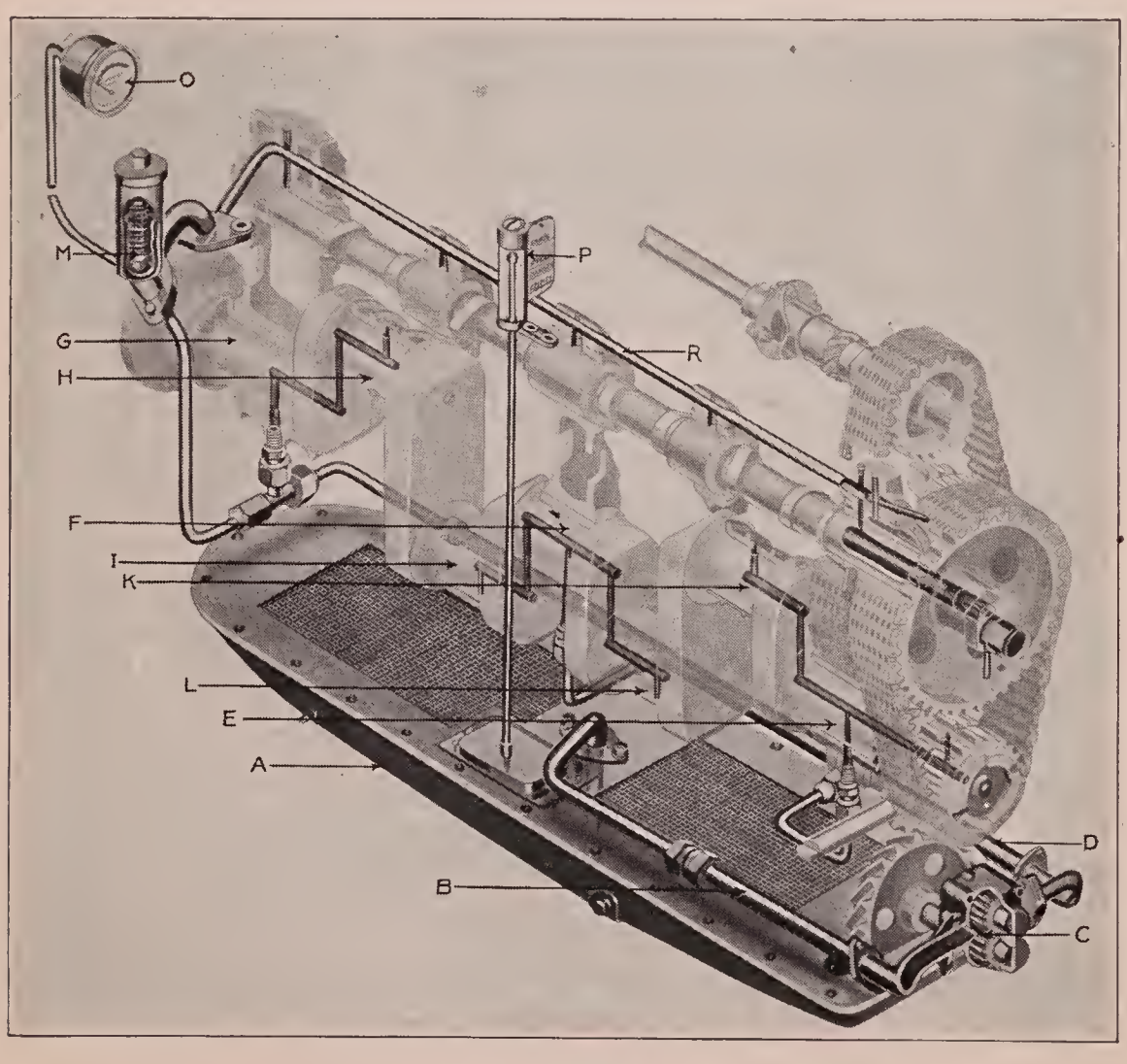


Fig. 51—Engine Lubricating System.

The pressure of the oil is regulated by an overflow valve or pressure regulator "M," containing a valve under spring tension. When the pressure is reached for which the valve is set, the valve is forced open and the oil overflows past the valve. A small hole "D," Fig. 53, drilled in the regulator housing allows oil to by-pass the valve when the valve is seated. Oil flowing through the by-pass and oil forced past the valve is carried to the camshaft bearings and power air compressor in the gasoline system through the pipe "R," Fig. 51, above and parallel to the camshaft. The forward end of this pipe is fitted with two nozzles from which oil flows into the camshaft sprockets and to the chains through holes drilled in the camshaft sprockets.

The crank pin bearings, "H," "I," "K" and "L," on the crankshaft, are lubricated by oil from the main bearings forced through holes drilled in the crankshaft. The hole drilled in the forward end of the crankshaft communicates with a hole drilled in the crankshaft sprocket through which oil is supplied to the camshaft chain. The cylinders are lubricated by oil thrown from the lower ends of the connecting rods.

There is one gauge and one indicator in the lubricating system. The pressure gauge "O" is located on the instrument board. The indicator "P" is attached to the upper cover of the crankcase near the carburetor and indicates the level of the oil in the oil pan "A."

Filling Lubricating System

A filling hole is provided on the fanshaft housing just forward of the distributor and timer. It is of the utmost importance that engine oil be free from dirt and lint and of suitable quality. (See under "Lubricants.")

Add oil if the oil level indicator "P," Fig. 51, is down to the line marked "Fill."

There is an oil level plug in the right-hand side of the oil pan. This is shown in Fig. 52. If the oil level gauge does not operate from any cause, or fails to register correctly, remove the oil level plug before starting to add oil, then add oil as above directed until it just starts to flow from the hole left by the removal of the plug. Then replace the plug and filling cap.

NOTE—If, on removing the level plug, oil flows from the hole for a few seconds, do not assume that the oil in the pan is up to the proper level. The level plug is at the lower end of a short standpipe which usually remains full of oil after the level of the oil in the oil pan has fallen below the upper end of the standpipe. The only way to be sure that the oil is up to the proper level is to allow the one or two teaspoonfuls of oil which has accumulated in the standpipe to drain off and then to add oil until it starts to flow from the hole.

When adding oil with the level plug removed, the oil level indicator should register "Full" when the oil just starts to flow from the hole left by removing the plug.

Replace Oil in Engine

At the end of each 500 miles of travel the engine oil should be replaced. To replace the oil proceed as follows:

Remove the drain plug, Fig. 52, and drain out all of the oil. Replace the drain plug and through the filler on the fanshaft housing, refill the oil pan with one and one-half gallons of fresh engine oil.

At the end of the first 1000 miles the car is driven, and at the end of each 4000 miles thereafter, the lubricating system should be cleaned and the oil pan and baffle plate removed and cleaned.

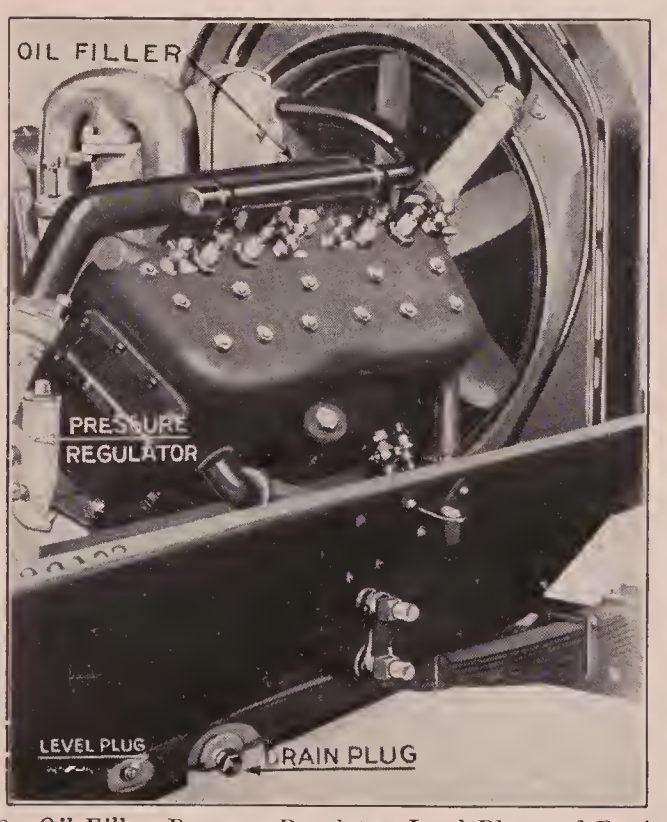


Fig. 52—Oil Filler, Pressure Regulator, Level Plug and Drain Plug.

To clean the lubricating system, first drain the oil, then refill the oil pan with a mixture consisting of three quarts of kerosene oil and one quart of engine oil. Run the engine at a speed of between 600 and 800 revolutions per minute for not more than one minute. Then stop the engine, drain the oil and remove the oil pan and baffle plate. Wash out the oil pan and clean the screen of the baffle plate. After replacing the oil pan, refill it with one and one-half gallons of fresh engine oil.

It is a good plan to clean the overflow valve and valve seat of the pressure regulator, Fig. 53, as well as the housing in which they are con-

tained, after forcing the mixture of kerosene and engine oil through the lubricating system. It is also important to make sure that the small by-pass hole is clean and free from any obstruction. A clean cloth, free from lint, should be used in cleaning the overflow valve. Do not use waste. The pressure regulator is located at the side of the crankcase just back of the right-hand block of cylinders.

Replace Oil Frequently During Cold Weather

The mileages given at which the oil should be drained and the oil pan and screen removed are those at which the work should be done during warm weather.

During cold weather a certain amount of water accumulates in the crankcase of the engine as a result of condensation. The water thus formed either freezes, preventing the pump from drawing oil, or mixes with the oil, forming a thick substance which the pump cannot draw. It is necessary, therefore, during cold weather to drain the oil pan and clean the oil pan and screen much more frequently than during warm weather.

The frequency with which it is necessary to do this work during cold weather depends very largely upon the manner in which the car is driven. In case the car is driven short distances only and frequent stops are made so that the engine base and the oil in the oil pan remain cold, it will be found necessary to drain the oil pan and clean the oil pan and screen much more frequently than if the car is driven longer distances with fewer stops, so that the engine base becomes thoroughly warmed.

A car that is constantly making very short trips in cold weather should have the oil drained every 350 miles, or once a week, and the oil pan and screen of the baffle plate cleaned once a month.

Unless the oil is drained and the oil pan and screen are cleaned frequently enough in cold weather, serious damage to the engine may result, particularly on cars in short trip service.

Oil Pressure

The pressure indicated by the gauge on the instrument board varies with the speed and temperature of the engine and the viscosity of the oil. When the engine is warm and supplied with fresh Cadillac Motor Oil or oil of approximately the same viscosity, the pressure as indicated by the gauge should be from five to seven pounds when the engine is idling. (When idling the engine should run at approximately 300 revolutions per minute, if the screw "B," Fig. 13, is adjusted properly.) At higher speeds a higher pressure should be indicated and at lower speeds, a lower pressure. Before the engine has become warm, higher pressures will be indicated at given speeds. In other words, maximum

pressures will be indicated at given speeds when the engine is cold and the oil is fresh; minimum pressures, when the engine is hot and the oil has become thin from use.

Adjustment of Oil Pressure Regulator

If, when the engine is supplied with fresh Cadillac Motor Oil, or oil of approximately the same viscosity, and the engine is warm and running at approximately 300 revolutions per minute, the pressure of the oil is more than seven pounds, a readjustment of the pressure regulator should be made. If the pressure is less than five pounds, dirt between the valve and its seat, or an incorrect adjustment of the regulator is indicated. To readjust proceed as follows:

Remove the cap "A," Fig. 53, by unscrewing it and loosen the lock nut "C."

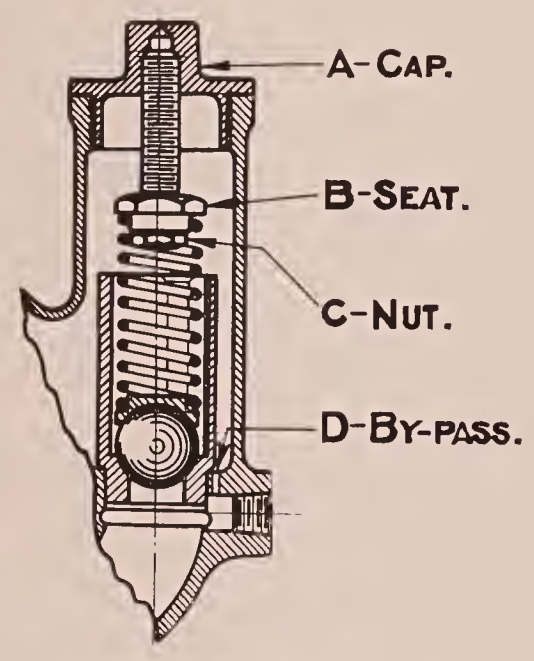


Fig. 53—Oil Pressure Regulator, Sectional View.

If a pressure of more than seven pounds is indicated, screw up on the spring seat "B." If a pressure of less than five pounds is indicated and the valve and its seat are clean, unscrew the seat "B."

Lock the adjustment with the nut "C."

If it is found upon replacing the cap and starting the engine that the pressure is still incorrect, remove the cap again and make further adjustment.

Caution—If when starting the engine after replacing the oil it is found that the gauge does not register pressure, stop the engine immediately and prime the oil pump. This may be done by disconnecting at its upper end the oil pipe from the pressure regulator and forcing two to three gunfuls of clean engine oil into the pipe. Connect the pipe and tighten the union before starting the engine.

TRANSMISSION AND REAR AXLE

Replace Lubricant on Transmission and Rear Axle

At the end of every 4000 miles of travel all of the lubricant should be drained from the transmission and rear axle, and these parts refilled with the correct amount of fresh lubricant. Cadillac Rear Axle and Transmission Lubricant is recommended.

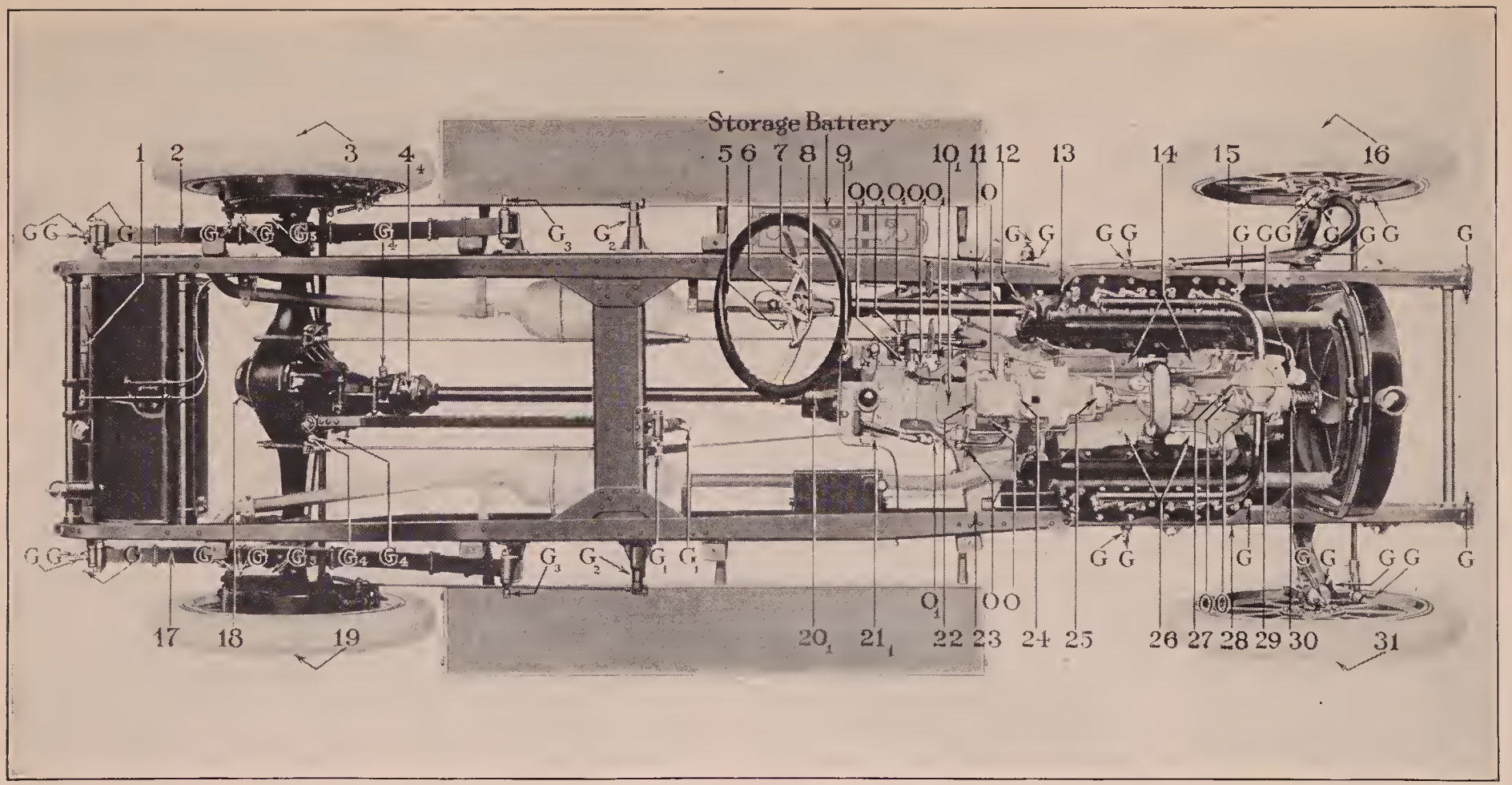


Fig. 54. General Lubrication Diagram

Each "G" indicates a grease cup. Each "O" indicates an oiling point at which a few drops of engine oil should be applied. Each number indicates a lubricating point for which instructions are given under "General Lubrication." Accessibility: The small figures at the right of and below the numbers and letters on the above diagram refer to the following notes as to the accessibility of the lubricating points.

1. These are lubricating points which are accessible after removing the floor boards forward of the front seat.

2. These grease cups lubricate the foot brake rocker shafts. They are provided with extensions which bring the grease cups within reach from under the running board.

3. These grease cups lubricate the bearings at the front ends of the rear side springs. The grease cups are accessible after opening the small doors in the dust shields just forward of the rear fenders.

4. These lubricating points are accessible through hand holes in the rear floor on all cars except the Roadster and Victoria. (On the Phaeton one of the hand holes is under the rear seat cushion.)

5. These grease cups lubricate the rear spring seats on the rear axle and are underneath the springs just back of the axle.

GENERAL LUBRICATION

Part of Car	Lubricant to Use	Total Amount	Location of Filler	
Engine	Engine oil	One and one-half gallons	On fan shaft housing	29
Bearings in fan hub	Engine oil	Several drops	Oil hole in fan shaft	30
Engine rear supports	Engine oil	Several drops	Felts in oil holes	11, 23
Valve stems	Engine oil	Spray from oil gun	Remove valve cover plates	14, 26
Bearings on armature shaft	Engine oil	Several drops	At front and rear of generator	24, 25
Tire air compression	Engine oil	Several drops in each oil hole	At front and rear of bottom of compressor cylinder	9
Bearing at upper end of steering shaft	Engine oil	Several drops	Oil holes at steering wheel	5, 6
Springs	Engine oil or Cadillac Rear Axle and Transmission Lubricant		Apply to sides and ends of leaves	1, 2, 15, 17, 28
Wheel bearings	Number one cup grease	Three ounces in each wheel	Remove wheels	3, 16, 19, 31
Starter gear shaft	Number two cup grease	Two ounces	Screw cap under nickeled plate on floor boards near accelerator	22
Mechanism in distributor housing	Number two cup grease	Ten ounces	Breather at rear of distributor housing	27
Transmission	Cadillac Rear Axle and Transmission Lubricant	Two Quarts	On right side of transmission case	21
Rear axle	Cadillac Rear Axle and Transmission Lubricant	Five quarts	On rear cover plate	18
Clutch thrust ball race	Cadillac Rear Axle and Transmission Lubricant	One ounce	On collar of ball race	10
Universal joints	Cadillac Universal Joint Grease or Number three fibre grease	Eleven ounces each	On casings around joints	4, 20
Steering gear	Cadillac Steering Gear Grease or a mixture consisting of ¾ 600 W Lubricant and ¼ number one cup grease	Three pounds	At "R" and "G" Fig. 18	12, 13

NOTE—The figures in the last column refer to the "General Lubrication Diagram," Fig. 54.

Evans-Winter-Hebb
complete Printing service
Detroit

LIBRARY OF CONGRESS
0 040 055 319 1